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AUTOMOTIVE and Uviation INDUSTRIES

JANUARY 15, 1945

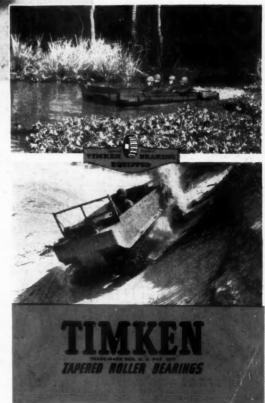


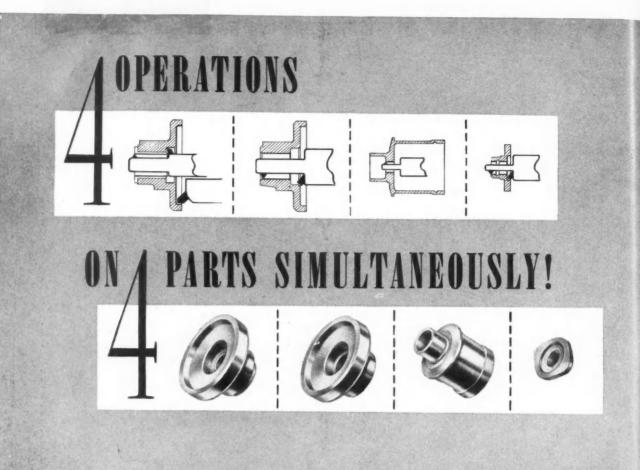
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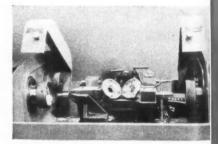
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Volume 92

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Volume 92, No. 2

We Should Make the Cartel an International Outlaw

By Julian Chase

IRTUALLY alone among the world's great nations, the United States has legislated emphatically and repeatedly against artificial monopoly and artificial trade practices. . . . It follows that no American can intelligently and sincerely promise you any cooperation in any system of world-wide controls. Our law is unsympathetic toward it; and our temperament is utterly hostile toward it. The average American would call it economic imperialism, and he is against it."

The words above were used by Eric Johnston in an address before the British Chamber of Commerce in London not much more than a year ago. He undoubtedly would repeat with emphasis and conviction the substance of them today. So would and do other Americans who think deeply about the basic contributing causes of America's present and historic economic greatness.

This means, if it means anything at all, that those Americans who have gone down to fundamentals in their analysis of economic causes and effects believe firmly that cartels, whether they be designed for selling or for buying, whether they be privately or governmentally operated or controlled, are not only antagonistic to American ideals but also will most surely prove, in the longer or shorter run, to be agencies that are destructive to world economy.

But in spite of all this, particularly in the field of world commerce, cartels during recent years have been and still are a growing menace. Cartels effectively curtail and often absolutely eliminate competition and thus stifle the most potent stimulus to progress. They put a curb on development and a limit on jobs. They attempt to distribute scarcity instead of tending to create abundance. They are restrictive and constraining. They are natural concomitants of the totalitarian state. They are European in conception, design and practice. They are totally

But what can we do, ask some of the timid ones as they assert that we must compete with cartels for our world markets. We can and most certainly should, in remaking the world, use our great weight and our as yet inadequately tested influence in taking a firm stand for world freedom of trade as outstanding leaders in their special field are today taking a stand for world freedom of the press. To aid in the effort to have the organization and operation of cartels placed in the category of outlawed international practices is a distinct duty that rests on every American and particularly on every American businessman.

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Let's Look at the Army's Spare Part Policy

ESPITE previous Army and War Production Board assertions to the contrary, investigations by the Senate Committee to Investigate the National Defense Program, headed by Senator James E. Mead, have disclosed that sizable Army stocks of surplus automotive replacement parts and other equipment are beginning to accumulate. The first indication of what was to come was brought out at a hearing before the committee in late November. Prefaced by several closed sessions with Army officials and by preliminary investigations dating back to last

April, the hearing was designed to examine the Army's policy of buying re-

placement parts from vehicle manufacturers, rather than directly from the parts makers. While the 17 Army officers and several War Department civilian officials, including Julius Amberg, special assistant to the Secretary of War, did a fairly creditable job of justifying procurement policy, the committee apparently still believes that there is considerable room for improvement.

By Eugene J. Hardy

Findings of the committee, incorporated in its report issued Dec. 19, include the following causes which are charged with having contributed to accumulation of surpluses:

- 1. Failure, in many cases—both avoidable and unavoidable, to forecast requirements correctly.
 - 2. Changes in design.
- 3. Failure to standardize specifications more generally.
 - 4. Duplication of procurement programs.
- 5. Procurement which has been poorly timed, indirect, and poorly controlled.
- 6. Keeping production lines going, although adequate stocks are on hand, so that productive capacity will be available at a future time when a greater demand is anticipated
- 7. Failure to develop and utilize more fully interchangeability information.
- 8. Establishment of too high control levels.
- 9. Inadequate inventory controls.
- 10. Failure to recognize and declare as surplus, useless accumulations of obsolete material.
 - 11. Other failures and inefficiencies in the

various successive functions comprising the pipe line.

Despite the critical tone of the report, the committee did not make a blanket condemnation of the agencies involved, but rather gave generous credit, where due, to the general excellence of performance. It conceded that in the early days of the war, speed in procurement was paramount and that a perfect job of buying could not be done. In its report, however, it points out that the psychology and buying practices developed in that period of extreme shortage must not

be continued under present conditions, and to that end has made the following recommenda-

1. That like articles used by the various branches of the services and their subdivisions be further standardized as to specifications.

2. That procurement of such like items be further centralized in one agency.

 That interchangeability information be further developed and utilized.

(Turn to page 64, please)

Equipment Standardization in Designing New Military Vehicles

by the Development and Planning Branch of the Office of the Chief of Ordnance, Detroit, as Reported to the Mead Senate Committee

Item			Total used in pre- production stage	Reduced for production to
Gasoline e	engines		. 48	23
	ions			28
	s			29
	8			28
Transfer	cases		. 61	18
Diesel eng	ines		. 32	9
Ventilatin	g valve		. 12	3
	ye			1
Pintles	***************		. 26	8
Turret loc	k assembly		. 4	1
Rings, tur	ret race assembly.		. 12	3
Capacitors	(radio suppression	1)	. 250	40
Gages (pa	nel instruments)		. 45	8
Filters, oil	cases		. 41	. 3
Towing ca	ables and chains		. 12	2
Towing he	ook		. 3	1
Lubricatin	g fillings		. 45	8
Clutches .	***************		. 53	19
Terminals	spark plug		. 10	1

dhesives and

By J. F. Mason Chief Material and Process Engineer, The Glenn L. Martin Co.

THE diversity and complexity of materials used in the construction of a modern airplane require that a variety of adhesives and sealants be employed to insure the integration of the component parts. Extensive improvements in the properties of the various types of bonding materials have been made in recent years, and it is anticipated that there will be further advances in the near future, for concerted research and development programs are currently in progress. These new developments should enable the aircraft design engineer to place an even greater degree of reliance on the adhesives evolved, since the bond strengths attainable in the future will tend to approximate the tensile strengths of the materials cemented.

Rubber and Synthetic Rubber Cements

Prior to the Japanese conquest of the East Indies and the subsequent all but total depletion of our crude rubber stock, reclaim and/or latex rubber base cements were used generally for bonding rubber to itself or to various other materials. These cements afford bonds which are adequate for most airframe nonstructural purposes if they comply with the requirements of the aeronautical specifications for rubber to metal shear loads. This shear test is conducted on a cemented area of four sq. in. of rubber strip bonded to a section of aluminum alloy and the rate of pull is 20 in. per min.

The use of rubber cements has diminished during the past two years because: (1) The curtailed supply of natural rubber, (2) the superior characteristics of synthetic rubber base cements and (3) the inadequacy of reclaimed rubber for the majority of aircraft applications have relegated them to a secondary status. United States Rubber Company's 5094 and Goodrich Company's Plastikon 169 are excellent examples of rubber base cements.

The general acceptance and approval of synthetic rubber base cements by the aircraft industry has kept pace with the rapid replacement of natural rubber by

synthetic rubber products. The cements used for airfr bonding the latter products to themselves or to varithe r ous other materials are formulated specifically for conju certain applications, and satisfactory results will be arom copol insured if careful consideration is given to the basic requirements. The cements may be divided into three adhes general classes; namely, Neoprene, Buna and Thiokol used and they should be used in conjunction with the corascer responding type of parent material, as indicated by to pr the synthetic rubber base from which the cement is prese formulated. However, the following discussion of their merits and limitations must be fairly general ceme since service experience gained may permit modificashoul tions and substitutions.

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The Neoprene cements more commonly used in air craft manufacturing are unvulcanized synthetic chloro prene compositions dispersed in a suitable solvent such as, benzol, toluol, aromatic naphtha, etc. The are so formulated that vulcanization will take place slowly at ordinary temperatures, but heat may be used to accelerate the cure. When the solvent evapo rates after bonding, the resultant thin film of Neoprens cement will be compatible with and will simulate the oil resistance and superior weathering characteristics of the original base. Due to their greater penetrative power, these cements have a higher bond strength than comparable rubber solutions. An excellent example of a Neoprene base cement is EC-711, manufactured by the Minnesota Mining and Manufacturing Co.

The Buna base cements, in like manner, may be formulated to retain all the properties of the basic vents butadiene — acrylonitrile or the butadiene-styrene ethyl copolymers. The Buna N cements are used in conjunction with the parent material for application where oil, low temperature, aromatic hydrocarbons of solvent resistance is indicated. The Buna S synthetic rubbers, however, do not possess all of the above characteristics. They are used in applications where low temperature, abrasion or oxidation resistance is required, and the Buna S cements are comparable in character. Minnesota Mining's EC-765 cement is suggested for evaluation in this usage.

The Thiokol cements, similarly, assume the characteristics of their original polysulphide base. There are several types of Thiokol in current use for various

Sealants

airframe applications, and after solvent evaporation, the resultant thin films of the bonding agents used in conjunction with them are as resistant to oxidation, aromatic hydrocarbons and paint solvents as the basic copolymer. Minnesota Mining's EC-570 is an excellent adhesive of this type. (Note: If Thiokol cements are used in contact with metal, care should be taken to ascertain the amount of free sulphur present in order to prevent any deleterious reaction on the metal in the presence of moisture.)

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The package stability of the synthetic rubber base cements is not too good over an extended period. They should not be ordered in large quantities and the recommendation of the manufacturer in regard to storage, as usually noted on the container, should be followed. It has been the experience of the author that these cements will not polymerize or jell in the container in a 90-day period if they are stored in a cool place and the cans are kept tightly sealed.

Thinning of synthetic rubber base cements should be avoided. They should be used as received from the manufacturer. However, if thinning is absolutely necessary because of solvent evaporation, the cement should not be thinned to a viscosity lower than that of the original packaged material. Careful consideration should be given to the choice of solvent materials used in thinning, since some of these cements are resistant to most common solvents. The Neoprene base cements may be thinned with coal tar solvents, such as benzene. The Thiokol base cements may be thinned

with chlorinated solvents; for example, ethylene dichloride. However, the Buna N cements will be more stable if thinned with the nitro-paraffins; for example, nitroethane, 1-nitro-propane or with certain of the chlorinated solvents.

The aromatic and chlorinated solvents are definitely toxic and care must be ex-

ercised to have the area in which they are used well ventilated. If it is necessary to apply the cement in a confined space, the operator should use a respirator connected to an outside source of fresh air. In addition, most cement solvents are inflammable, and care should be exercised to keep them away from sparks or flame.

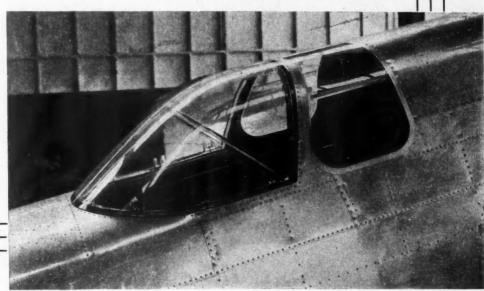
The procedure for obtaining a strong cement bond is standardized generally, and the following brief description of the process is but intended to underscore the several important steps involved.

1. The surfaces of non-metallic and non-porous materials which are to be cemented must first be roughened by sanding, buffing with a fine wire wheel or other such means. This will provide a scuffed surface structure which will improve the bond strength, since the fibers will tend to become embedded in the cement film. The sanding or scuffing operation should not be done in cases where the abrasion would be detrimental to the materials involved.

2. A clean surface is essential to obtain a strong bond. All surfaces to be cemented should be thoroughly cleaned of oil, grease, soapstone, talc, etc., by means of a cloth dampened with naphtha or unleaded gasoline before the bond is made.

3. When possible, both surfaces to be bonded should be coated (Turn to page 98, please)

Window cemented into place on the Martin Baltimore (Model 187)



Ford Develops Tri-Alloy B

REATLY increased bearing life for Ford postwar automobile and truck engines is indicated by development of a new "tri-alloy" bearing by Ford Motor Co. engineers. It is estimated from tests made in the dynamometer laboratory and under actual heavy duty trucking operations that the new bearing will give from two to three times the service life of conventional bearings, even under the most severe conditions.

The principal advantage of the tri-alloy bearing is said to be its ability to stand up under heavy load at high speed operation. In road tests on heavy-duty Ford trucks operating between the Willow Run bomber plant and the Southwest, some bearings and crank-

shaft journals showed no measurable wear at the end of 50,000 miles of service. In other cases, wear up to 0.0005 in. has been recorded after 40,000 to 50,000 miles of use. In general, the bearing wear factor is about the same for cadmium and tri-alloy bearings with the crankshaft journal showing a little more wear when the tri-alloy bearing is used, but not enough to be significant. However, resistance to bearing metal fatigue is greatly improved.

The new bearing was developed at the request of the Army Ordnance due to scarcity of cadmium and in a general search for improvement. Ford engineers tried various combinations of metals, finally evolving the tri-alloy material consisting of 35 to 40 per cent lead,

4½ to 5 per cent silver, and the balance copper, with a trace of iron. The fact that Ford uses double face floating-type bearings, complicated the problem. It was known that single-face copper-lead bearings were easy to make, but when coating both sides to make the floating bearing, segregation of lead created weak points. Observation showed, however, that segregation of the lead did not occur in this new alloy.

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Since existing methods of casting copper-lead bearings were too costly, the next hurdle was to find at economical method of volume production. This was solved by digging out of the archives a technique which had been perfected by Ford ten years ago for casting copper-lead bearings and which had been



(Above) Two-in. steel strip passing through the sweat" furnace with the tri-alloy metal at 2100 F. The water jacket for the die is visible at the bottom of the furnace.

(Left) Pouring tri-alloy bearing metal at 2300 F. from an electric induction furnace at the Ford River Rouge plant. The copper and silver are melted first and the lead added just be for pouring. The "secret" of the tri-alloy metal is said to be in the weight proportions of the metals before charging the furnace.

By Leonard Westrate

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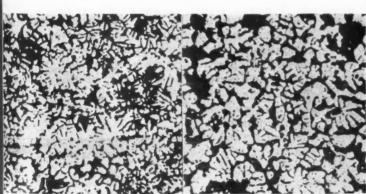
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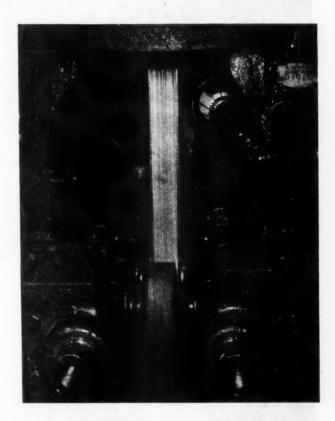
abandoned with the introduction of the cadmiumcoated bearing. The process, set up on a continuous basis, starts with a large coil of low-carbon, openhearth, hot-rolled, pickled steel strip 2 in. wide and 0.075 in. thick. By means of knurled rolls the steel strip is pulled from the ground floor to a sub balcony and through a coating furnace on this balcony. As strip passes through coating furnace, which is held at 2100 F, it is pre-heated in the upper part of the furnace and in the bath of molten copper-lead-silver. It then passes on into the forming die, located at the bottom of the bath, which allows just the desired amount of metal to leave the bath to conform to dedesired thickness and form. The alloy is melted on this sub balcony in induction furnaces and poured into coating furnaces periodically.

Carefully selected and prepared graphite is used for the die because it is the only material that will withstand the high temperatures involved and also provide lubrication for the strip which passes through at the rate of 8 in. per minute. The dies are machined in the Ford shops and have an average service life of 35 hours. The lower half of the die extends below the bottom of the furnace and is encased in a water jacket which causes the alloy to solidify and chill swiftly down to about 200 F. From the furnace, the strip passes downward to a shearing machine on the main floor which cuts it into segments approximately 11 in. long, enough for three bearings. These pieces are run through a chamfering machine to bevel the (Turn to page 96, please)

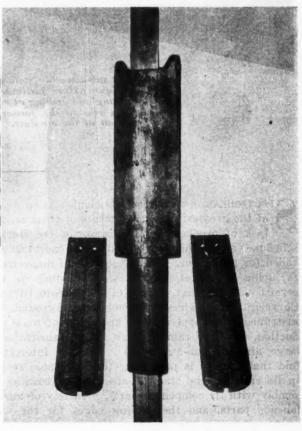


(Above) Microstructure of (left) tri-alloy bearing metal—5% silver, 40% lead and 55% copper; (right) copper-lead bearing metal—35% lead, 65% copper. Magnification 100x.

In the center of the illustration at the right is shown how the metal strip enters the boot (top) and the die, emerging from the latter, the lower half of which is waer-jacketed in the production set-up. Displayed at each side are the two halves of the graphite die. The orifices through which the hot metal is introduced are visible on both dies; the oil groove former on the one at the left.



(Above) Tri-alloy coated steel strip passing through a strip coating machine. Thickness of the bearing metal, averaging .140 in. is controlled in the die.



January 15, 1945

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TRIES



The cowl flap assembly department in highly mechanized in view of the relatively large volume of particular flow. It is developed symmetrically about the conveyor belief shown in the center,

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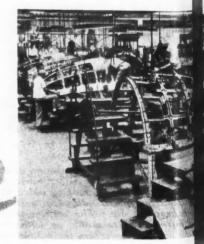
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DeSoto's Part in **B-29** S

sections. Altogether the DeSoto assembly plant buys some 6800 parts of all kinds from a group of some 350 vendors, including stampings from the DeSoto press shop in Detroit, and some 3000 parts from other divisions of Chrysler Corp. Most of the aluminum and stainless steel stampings and steel magnesium forgings are made by Chrysler divisions.

Owing to the tens of thousands of detail operations which are performed by hand, and the complexity of even small sub-assemblies, this article covers only a generalized survey of the facilities. A sampling of the interesting operations in each department, by illustrations, will serve to give the reader a better visualization of some of the production activity.

Dominating the production scene is the section of the plant devoted to the fabrication of the nose section. Assembly starts at the far end of the build-



SPECTACULAR in size, the B-29 bomber is easily one of the greatest accomplishments of the war. The task of producing the elements of the B-29 on schedule and at the desired rate was enormous and called for the pooling of the resources of many manufacturing organizations. This brief study is concerned with the contribution of the DeSoto Division, Chrysler Corp., whose automotive background was instrumental in applying the know-how of mass production, in all its ramifications, to the fabrication of large airplane sub-assemblies. It is of interest to find that DeSoto is producing the huge nose section in its entirety, the stainless-steel engine cowling assembly with its component parts, a variety of miscellaneous parts, and the leading edges for the wing

Air duct sub-assembly station.

This unique fixture facilitates the locating and drilling of re-

inforcing ribs to the forward position of the air duct.

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ing and continues to the other end for a length of about 900 feet, the forward half of the line being devoted to the installation line. Initial assembly stations are served by a group of sub-assembly departments, preparing in order the various circumferential frames, the pilots' floor, navigators' floor and turrets, pressure bulkhead, pilots' cabin.

Assembly operations begin with the integration of the pilots' floor and circumferential frames in massive framing fixtures in which the sections are meticulously aligned and tack-riveted. Then the subassembly is removed from the fixture and moved to an open framing jig to facilitate the complete riveting of the structure. This sub-assembly then is installed in the huge steel major framing fixtures—ten in the line-for the final assembly. This fixture brings together the major elements including the navigators' floor and turret, the pressure bulkhead, pilots' cabin, and other details. Upon completion of the assembly, the operators fit and install the skin sections. At this stage the ends of the massive framing fixture are moved away so as to permit free access to all parts of the structure for riveting operations on the skin.

An interesting commentary on this phase of the assembly job is the fact that DeSoto had to accommodate the operation to the limitations of an existing automotive type building. Whereas the new airplane assembly plants with their 45-foot high ceilings can handle the enormous sections with ease, DeSoto was limited by a 15-foot ceiling height. This problem was met by installing the assembly line directly under the saw-tooth roof section to gain additional height advantage, placing the beds of the fixtures in pits in the floor. Even then the fixtures had to be modified so as to hinge at one end and the railings around the fixtures were made removable. When a nose section is ready for removal, it is hoisted up to the ceiling level, rolled out on rails over the aisle, and dropped

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9Sub-Assembly Pool



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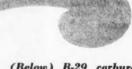
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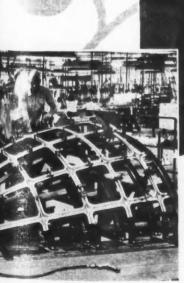
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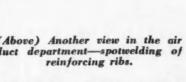


(Below) B-29 carburetor elbow fabrication department. The assembly is built up of separate panel sections and gas-welded into an integral unit in the special trunnion type fixture shown here.



(Above) Another view in the air duct department—spotwelding of reinforcing ribs.

(Left) A view of a section of the pilot's cabin assembly department, emphasizing the development of massive steel framing jigs.



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The nose section pressure bulkhead is assembled in this enormous fixture.

onto a truck or dolly. These dollies are rolled onto the assembly line directly ahead of the framing fixtures for the finishing touches so as

> to reach points which were quite inaccessible while the section was in the fixture.

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Following this. the sections are moved to the installation where they are outfitted with instruments, controls, upholstery, wiring harness, etc., etc. At the end of this line the nose section is ready for shipment to the B-29 assembly

Returning to the sub-assembly departments, we find that all parts are prepared from individual stamp-

forgings, brackets, etc., received in finished condition from vendors. All stampings are precision die cut, so as to effect complete interchange-(Turn to page 50, please)

completely plant.

ings, and fitted with

(Left) Pilot's floor assembly department. At the left is the riveting station; at the right, the sub-assembly fix ture, in which the section is completed.

(Right) Closeup of the major fixture line for the nose section—at the left, start of assembly; at the right, an assembly nearly completed.

(Right) Closeup of another of the spe-cially designed sub-

assembly fixtures. This provides the means for locating

holes in the inner cowl panel so as to match the nacelles

and engine mounts

produced by subcontractors.

attachment



TKS Airframe

De-Icing System

Particulars have been released in England of a new system of airframe deicing in which a special fluid is distributed uniformly (and con-

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tinuously if and when required) over the whole of the airfoil surfaces, forming a boundary layer or film to which ice will not adhere. Known as the TKS system, it has been developed by co-operation between the Tecalemit Co., the Kilfrost Manufacturing Co. and the Sheepbridge Centrifugal Castings Co. Flight experience under a wide variety of icing conditions has proved that this system affords adequate protection against the ice menace, without adverse effect upon the aerodynamic efficiency of the aircraft.

The system comprises a supply tank containing a special de-icing fluid, which is delivered through pipe-

By M. W. Bourdon

Special Correspondent of AUTOMOTIVE and AVIATION INDUSTRIES in Great Britain

lines by a motor-driven multioutlet pump to one or more porous metal distributors inset at the leading edges of the wing, tailplane and fin. From the

distributors or spreaders the fluid is carried by the airstream over the entire surface of each airfoil.

Two rates of flow are provided for, one for normal and the other for emergency use. This is effected by the motor controller, for by appropriate use of this unit the pump can be run either intermittently at a time cycle of 1 "on" and 4 "off" for normal flow or continuously for emergencies. The controller can be brought into normal operation either manually or automatically by an ice detector. Emergency operation is controlled by a manual switch only. To wet the airfoil surfaces quickly and thoroughly when the

system is first switched on, the normal intermittent flow is always preceded by an initial period of continuous running.

As indicated in the diagrammatic layout (Fig. 1) of this system applied to a four-engined aircraft, the distributors are in sections, the length of which ranges up to 15 feet, according to requirements. If necessary they can be pre-formed to a (Turn to page 74)

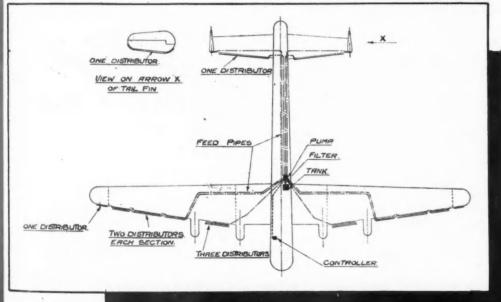
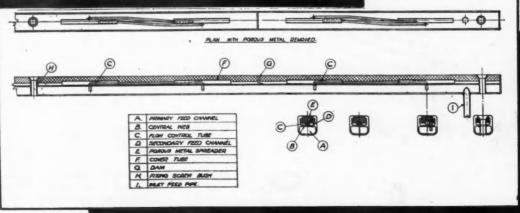


Fig. 1—(Above) Diagram of four-engined aircraft showing typical layout of the TKS de-icing system.

Fig. 2—(Right) Plan, elevation and sections of a TKS porous metal spreader.



HE BT-13 "Valiant" was the first American airplane to be mass-produced on a mechanized assembly line. The prototype rolled out of a hangar at Vultee Field near Downey, Calif., in March, 1940, and since then 11,537 replicas have been constructed. Although originally designed for the Army Air Forces, many Valiants have been built for the Navy. The latter are designated as the SNV-1's or SNV-2's (see Fig. 1).

has a NACA symmetrical 18 per cent airfoil section; at its tip, a NACA symmetrical nine per cent airfoil section. Total wing area is 239 sq ft. The angle of incidence is 3.5 deg, and dihedral at the leading edge is seven deg. Sweepback at the leading edge of the center section is 3.5 deg; the aspect ratio is 7.4 to 1.

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The ailerons have a total area of 19.3 sq ft, and may be moved 25 deg up or 11.5 deg down. The elevators

A two-place monoplane, the regular Valiant is powered by an R-985-AN-1 or -3 Pratt and Whitney engine. It has a low cantilever wing, monocoque fuselage, single-fin empennage, and fixed landing

Design Analysis

gear. A special version called the BT-15 is the same as the BT-13, except principally that it is powered by a 440 hp R-975-11 Wright engine.

According to specifications, the Valiant has an operating speed of 140 mph and a maximum speed of 164 mph at sea level. Its endurance at operating speed is four hours, and its service ceiling is 16,500 ft. With flaps, it will take off and clear a 50-ft obstacle in a distance of 1175 ft. It climbs to 10,000 ft in a period of 13 minutes, and lands over a 50-ft obstacle (with flaps) in a distance of 1125 ft.

Wing

The full-cantilever wing is of the stressedskin type, tapering in plan form and thickness ratio and comprising a center section with two detachable outer panels. The internal structure is fabricated from sheet and extrusions, using riveted construction and employing light alloy and steel forgings or castings for the more highly-stressed fittings. At its root, the wing

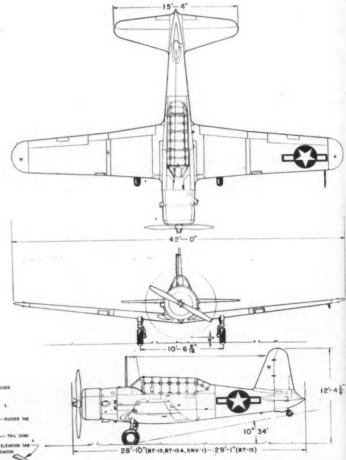


Fig. 2—(Above)—Dimentional drawing of BT-13.

Fig. 3 — (Left) — Major component assemblies.

Fuselage equals monocoque forward to firewall minus center section. Empennage equals vertical stabilizer plus rudder plus rudder tabs plus horizontal stabilizers plus elevators plus elevator tabs plus tail cone.

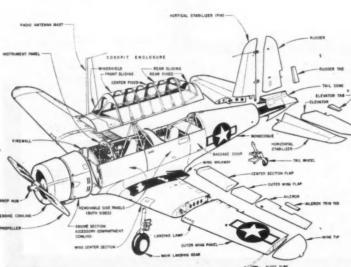


Fig. 1—The BT-13 basic trainer. Experimental versions of the BT-13 and BT-15 with fuselages made of glass fiber laminated with a new contact resin have been developed by the Air Technical Service Command at Wright Field.

By H. H. Cooke

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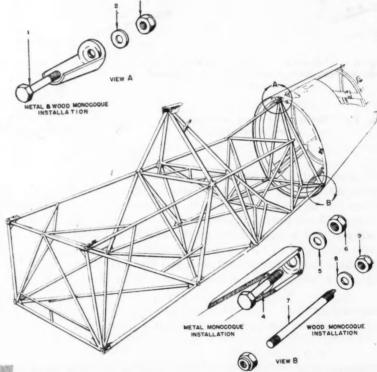
Engineering Services Section Head, Vultee Field Division Consolidated Vultee Aircraft Corp.



of the Valiant BT-13

Design Data (See Figs. 2 and 3)

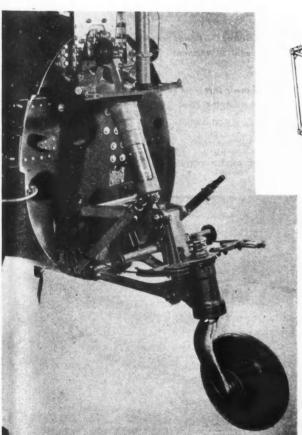
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Maximum length ,	28 ft 10 in.
Maximum height	150 in.
Wing span	42 ft
Thickness of root chord	15.93 in.
Thickness of tip chord	4.50 in.
Ultimate load factor	8.5
Taper ratio (root chord/tip chord)	1.88 to 1
Length root chord	7.75 ft
Length tip chord	4.11 ft.
Maximum fuselage depth	6.5 ft
Maximum fuselage width	4.5 ft
Gross weight for stress analysis	4498 Ib



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Fig. 4—(Above)—Fuselage tube structure-to-monocoque structure attachment.

Fig. 5—(Left)—Tail gear installation.



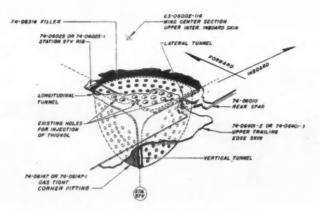
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CUTAWAY VIEW AT OUTBOARD UPPER REAR CORNER FITTING LEFT HAND

25 per cent of the wing chord. The flaps are made in four sections, two attached to the wing center section and two attached to the wing outer panels. Structurally, the individual sections are similar to the ailerons, except for the fact that the lower surface (aft of the beam) is of sheet metal reinforced by stamped beads and without lightening holes. They have an area of 25.11 sq ft and can be moved approximately 60 deg.

The horizontal tail surfaces have a total area of 53.22 sq ft along with a span of 15 ft 4 in. and a maximum chord of 5.04 ft. The fin has an area of 8.06 sq ft; its normal setting is zero and it is non-adjust-

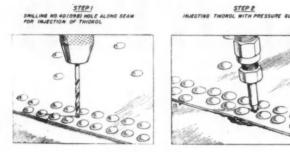


Fig. 6 — (Above) — Injecting Thiokol to fuel tank corner fittings and seams by external injection method.

Fig. 7 - (Right) - Engine and propeller controls diagram.

have a total area of 19.22 sq ft, and may be moved 30 deg up or 25 deg down. The rudder has an area of 10.56 sq ft, and may be moved 35 deg to either right or left.

Aileron tabs are adjustable on the ground only and have a total area of 1.37 sq ft. The elevator tabs are controllable, and have a total area of 1.99 sq ft. The controllable rudder tab has an area of 0.79 sq ft.

Empennage

NACA slotted wing flaps are installed over about

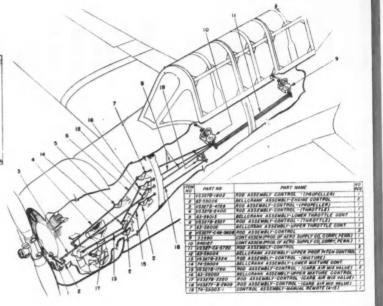


Fig. 9-(Below)-Front cockpit controls-right side.

- 2—Cockpit spotlight 3—Control stick 1-Rudder pedal adjustment lever
- Fig. 8—(Lower left)—Front cockpit controls—left side.
- 1-Instrument flying hood release
- 2-Extension handle-fuel tank
- Rudder tab control Throttle control
- Propeller pitch control
- 6-Mixture control
- 7-Fluorescent light
- Emergency fuel pump
- Elevator tab control

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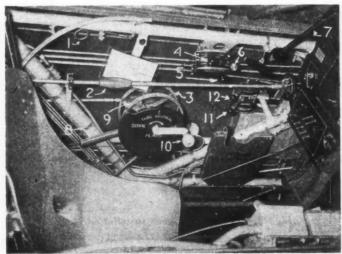
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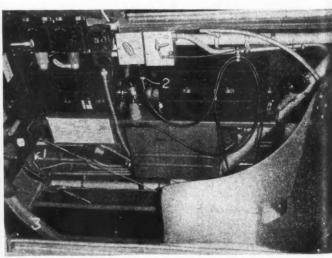
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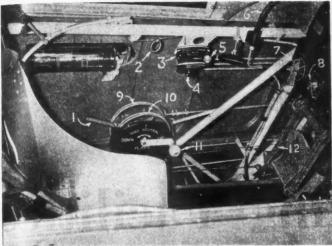
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- 10—Wing flap control handle 11—Carburetor air control
- 12-Oil cooler shutter







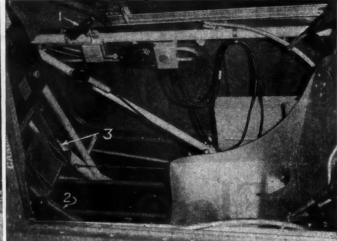


Fig. 10-(Above)-Rear cockpit controls-left side.

- 1-Emergency fuel pump
- 2-Instrument flying hood release Throttle control
- Propeller pitch control
- -Mixture control

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- 6-Fluorescent light -Fuel tank selector valves
- Ignition switch
- 9-Rudder tab control
- Elevator tab control
- -Wing flap control handle -Rudder pedal control

Fig. 11—(Top right)—Rear cockpit controls—right side.

- 1—Cockpit spotlight 2—Control stick
- s-Rudder pedal adjustment

able. Both horizontal and vertical stabilizers are constructed in essentially the same manner, except that the former consists of two symmetrical surfaces joined along the airplane's centerline while the latter is a unit structure. Otherwise, it might be said that a channel section beam in combination with formed ribs comprises the basic structure of each fixed control surface, which is covered with smooth sheet metal attached by means of brazier-head rivets. The movable control surfaces are covered with smooth, flush-laid fabric and swing on hinges, incorporating shielded anti-friction bearings. A surface-control locking device is provided in the front cockpit to prevent movement of the control surfaces when the airplane is parked.

Fuselage

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The maximum cross section of the fuselage has a height of 6.5 ft and a width of 4.5 ft. The composite fuselage structure includes a formed section of chrome-molybdenum steel tubing welded to form a truss frame essentially comprised of four longerons, suitable struts, and diagonal bracing members (see Fig. 4). Fittings are provided at the foremost end of the longerons for connecting the engine mount. Fittings on the lower longerons enable the wing center section to be connected to the fuselage. At the aft termination of the fuselage longerons, three fittings are provided for attachment of the fuselage semi-monocoque section. The aft bulkhead in this section carries fittings for the empennage group and tail landing gear.

A flame-tight steel bulkhead acts as the firewall

separating the engine compartment from the fuselage. Aft of this is the fuselage forward section, which is covered by readily-removable panels of aluminumalloy sheet. These removable panels are curved to give a smooth contour to the fuselage, beginning as an approximately circular section at the firewall and fairing into a semi-elliptical section at the junction with the monocoque section.

Both of the cockpit openings are in the top of the fuselage steel tube section. Forward of the front cockpit there is a windshield of shatter-proof glass mounted in a light alloy frame. Extending from the windshield to the aft edge of the rear cockpit is a telescoping enclosure which consists of an aluminumalloy framework, in which transparent panels are mounted. Emergency exit panels are provided in each side of both the front and rear movable sections, arranged so that movement of a release handle (accessible from both inside and outside the enclosure) will free the panels from the enclosure frame-

An overturn structure, formed from welded steel tube and plate, is located between the cockpits to protect the crew in the event of a nose-over on the ground.

Forward vision from the rear cockpit is approximately 4.5 deg downward from the horizontal. The front cockpit provides unobstructed vision forward and downward on either side of the fuselage with minimum movement on the part of a pilot.

The engine mount is a welded steel tubular structure, consisting of members connecting a mounting ring to four fittings for attachment to the fuselage longerons at the firewall. Vibration-absorbing bushings are used in connecting the engine to the mounting ring.

Alighting Gear

Main landing gear comprises two cantilever struts, each carrying one 27 in. smooth-contour-type wheel and tire, on a tread of 19 ft 69/16 in. Each strut is a chrome-molybdenum steel tubular structure containing a shock-absorber unit. The hydraulic brakes are operated by pivoted foot pads, mounted on each of the rudder pedals and connected by bellcranks to master (Turn to page 46, please)



General perspective in silver plating department with the strike line in the foreground, center

Electroplating Facilities

In the finish-machining department—a closeup of the single-spindle precision-boring machine. Attention is drawn to the massive tool holder which is hydraulically actuated for any given cycle of the cutting tool



Closeup of Universal silver plating machine with emphasis upon provisions for individual mounting of word racks and control of racks

Centralized at Republic Plant

plating of precision aircraft engine parts and for general electroplating operations mark the latest stages in the expanding manufacturing program of Republic Aircraft Products Division of The Aviation Corp. By combining the latest types of plating equipment with techniques developed by Republic specialists, it is claimed that pure silver coatings averaging 0.020 in. in thickness are produced with unusual rapidity and with excellent quality control.

The reader is referred to the Nov. 15, 1943, issue of AUTOMOTIVE AND AVIATION INDUSTRIES in which we covered the manufacturing facilities of this unit. At that time the silver plating department had its beginning in a corner of the heat treating department. Today, the electroplating department has become a selfcontained unit housed in the building formerly serving as the training center for new employes. One section of this department is devoted entirely to silverplating operations; another section contains a large cadmium-plating unit, a copper plating unit, and strip tanks for salvaging silver and copper plated parts.

In addition, another section of the building is equipped with universal type finishing machines for the finish-machining of silver-plated parts. At the present writing these consist of a Universal miller; a precision boring machine with a hydraulic attachment for auto-



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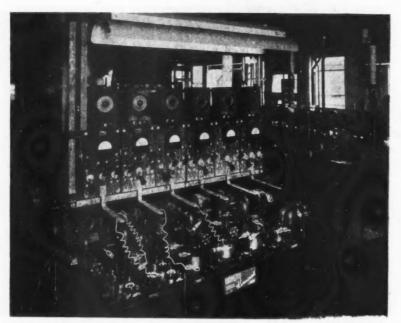
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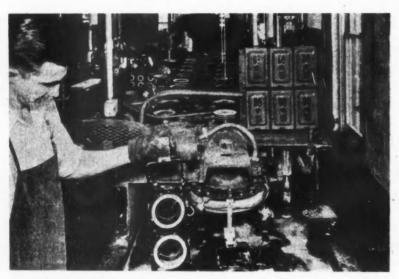
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The "flush" plating machine in which the solution is circulated in conformity with the inner and outer contour of the work



The 28-station semi-automatic face-plating machine at the operator's station where racks are loaded and unloaded. The machine has provision for regulating the time cycle in accordance with the surface area of the work. At the rear is the mechanism for agitating the solution.

matic profiling operations; and two two-spindle precision boring machines. Cemented-carbide tools are employed for all finishing operations.

Heavy silver plating for high unit loading aircraft bearing applications is a relatively new art which is being rapidly exploited by specialists in the automotive field. Such fundamental criteria as durability of the bond, quality of surface finish, and production economy in terms of speed of plating—all have been developed independently by the specialists in various plants. At Republic considerable energy is being devoted to fundamental research, production control and the development of new techniques.

One of the major items of equipment is the semi-

automatic silver plating machine used for face plating. There are two large universal silver plating machines for handling work requiring the plating of large OD and ID, and faces. Unique features of these machines are the provisions for agitation and individual motor driven work holding fixtures. A smaller universal type plating machine of the same type is used for the plating of small parts requiring ID and face plating. What is said to be strictly a Republic development is a flush tank silver plating unit for small pieces requiring ID and face coating. This exhibits unusual provisions for circulating the solution within cavities and following outer contours for face plating.

Serving the plating machines is an integrated group of tanks constituting the strike line. Here the work is successively cleaned in chemical solutions, rinsed, given a copper strike for secure bonding, then a quick silver strike in preparation for the semi-automatic machine. The silver strike is a double coating, produced in two separate still tanks. Lead-plating and indium plating equipment also has been installed for providing the protective flash coatings of lead or lead-indium specified for some of the parts.

Distinctive feature of the Republic silver plating technique is said to be the special ability of plating combinations of ID and OD in one operation with further combination of face plating of both inside and outside surfaces in a single feature and in one setting.

Spiders or locking plates, produced in large quantity and which require face plating only, are handled in a special setup. The work is masked with stopoff lacquer developed for the purpose. The lacquer is applied by hand and dried in a small infra-red lamp furnace before assembling the parts on the plating fixture. After plating, the lacquer is removed by immersion in a degreasing machine. Cylindrical parts, requiring silver plating of OD, ID and face combina-

tions, are masked with specially designed plastic pieces precision-machined for accurate conformity to the shape of the work.

Following silver plating the work is ready for finish machining to size. Large volume work such as the locking plate is transported to the main machine shop for processing. However, the general run of parts required in moderate quantity is finish-machined in this plant. Interesting example of versatility in this connection is the precision boring machine which is fitted with a single cemented-carbide tool actuated by a hydraulic profiling cycle attachment. In one setting, this machine can be arranged

(Turn to page 116, please)

The predictable, minimum distortion characterizing molybdenum carburizing steels helps reduce the cost of producing precision parts

CLEMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.



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Airbriefs

By Henry Lowe Brownback

Corrosion

One of the most important phases of aircraft construction for private airplanes will be the prevention of corrosion of light metal parts as corrosion pits can start cracks that may cause serious trouble. It will not be enough to enamel the parts or to coat them with some thin protective coating. Every effort should be made to develop materials of high strength which are inherently corrosion resistant or to adapt our present corrosion resistant metals to small aircraft structures. Thought must be given also to the treatment of these metals or materials so that straightening an accidental bend will not cause failure. It is all right to say that this cannot be done because "it is aircraft," and such things are not done with aircraft, the sad fact is that it will be done and has been done in private aircraft since flying began when Government inspectors were not

nearby. It has been easy to enforce rules about licensed airplane and engine mechanics as long as there are few aircraft flying. but just as soon as you get a lot of them it is going to be impossible just as it has been to enforce prohibition and gasoline rationing. In France where it has always been easier to enforce rulings than here, the "Pou de Ciel" craze in the 1930's made a joke of enforcement and many people built the little machines and other little jobs like the HM-7 and flew them out of all sorts of fields in open rebellion against the aircraft laws. While I do not advocate anything like that here or anywhere else, you are going to have an absolutely impossible law enforcement problem on your hands with some thousands of former military pilots who may want to fly and who have little money, but who can get some second hand plane and patch it up and fly it. rules or no rules. The makers of air-liners and military aircraft can design their structures for the use of expert pilots and servicing by super mechanics. but the builder of flying "flivvers" must make his product to be repaired with auto supply nuts and bolts as well as considerable baling wire. If the job won't take it, his reputation is going by the board.

I think that the real reason that Henry Ford made a billion with the model T was because anyone could fix it when it got stalled and if it got banged up any blacksmith could straighten the parts with a sledge and send it on its way. Mr. Fokker told me many times that he preferred ordinary carbon steel for his parts because it was hard to spoil them while welding, they could be straightened without damage and they didn't need heat treatment. I realize that this would be bad technique in the manufacture of commercial planes where every pound saved means dollars earned but for bangabout planes, it is vital.

Ventilation

Even though the war is our present major problem, all of us must think about making a living after the war and in order to do that we must have products to manufacture and sell. One of these products is the airplane and everyone in the business is trying to get something ready which the public will buy.

If the motor car is to be taken as a criterion, the postwar airplane will be a cabin job and here the designer should profit by the mistakes made by the motor car body designer who started in by putting a horsedrawn broughan body on a motor vehicle and then held on to many of its bad features, particularly ventilation. When you get two to six persons in a small space in which the air must be changed frequently and be kept cool in summer and warm in winter without drowning out the occupants in heavy thunderstorms or fogging the windows, it takes more than a few trick windows and a cowl ventilator, or a dinky little heater blowing hot air on one or two passengers' knees, letting the rest freeze, to provide the ventilation necessary to keep the windows from fogging or frosting in winter. Every time I take a long trip in a closed automobile or a small plane I wind up with a miserable cold and I am not the only one.

It should be very simple to construct a good heating unit close to the engine and send heated or cool air through ducts, with inlets so baffled as to remove all rain or snow, and distribute it down low instead of in a blast on one's knees and then have ducts to take out the vitiated air without creating a draft.

Such a system should be absolutely automatic and furnish enough heat in winter to keep an even 70 deg. in the cabin and in the summer to give a good supply of cool dry air even in heavy thunderstorms. It is only fair to say that some motor car manufacturers were trying some devices of the sort

before the war broke out, but all were inadequate. The light airplane was in about the same stage of development as the first closed cars. The prewar buy. ers of aircraft were often sportsmen of the type who get a lot of fun out of bouncing about in an outboard racer or on a motor bike, but the large postwa buyer market will be the type of per son who enjoys air-conditioned Pull. mans and insists on similar comfort in his private transportation. As a race we are not getting any more hard yearly but, on the other hand, are de manding more effortless comfort even year. If you don't believe me look at the fate of almost everything requiring d. fort and discomfort. The man who will win out in the years to come will be he who gives the best value and who has put the most logical planning into the designing of his product.

Controls

There seems to be a dawning realization that airplane controls must be simplified before the average man can fe altogether comfortable in piloting. This means that turns will be made by bank ing if no rudder control is used or that banking will be accomplished by di hedral in the wings where no aileron or other positive lateral control is used I might cite several very successful air craft which have used both system one being the tandem gliders buil by Professor Montgomery steered by banking entirely and the tandem win system used gave a great degree of control and inherent stability. The lat ter system was used in the Mignet Po de Ciel, also an inherently tandem. Simple controls were also used on the V-shaped planes like the Dunne when the turning was done by banking and i the modern Erco as well as some other which have slipped my memory. Sud simplified controls do away with the danger of crossed controls, a major hazard in piloting by the not too expert

Where banking is used for turning, is seems to me that the aileron turning up to depress the wing rather than the descending aileron is preferable. The descending aileron, while more powerful, really works against the rudder is an ordinary plane as it increases the drag of the wing on the outside of the turn while the depressing aileron aid the rudder. Of course there are other considerations in favor of the descending aileron.

Propellers

Some time ago I wrote about the desirability of controllable pitch propellers for light aircraft. I have just been reading a description of a very cleve "prop" recently developed for this field with a most simple mechanism working through the differential action of a positive chain drive and the variable action of a vee-belt with an infinitely variable ratio between adjustable pulleys the ratio being regulated by a governor.



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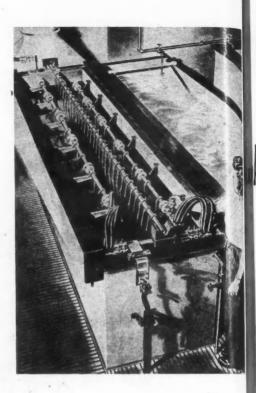
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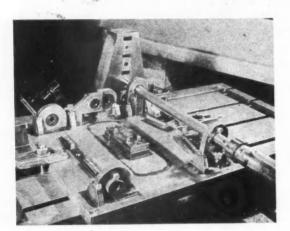
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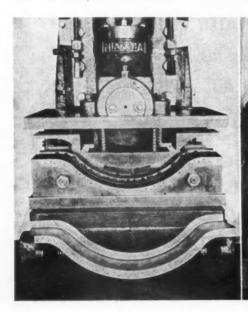
Through the use of a new adjustable anode rod, faster plating of irregularly shaped parts and more uniform and even tempered metal deposits are being obtained in the finishing and plating department at the Glenn L. Martin plant, Designed for use

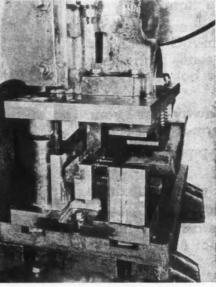
with elongated, mass-production plating tanks, the new installation consists of brackets welded, bolted or riveted to the walls of the tank to which steel plates or arms insulated on either side with phenol fiber are pivotally attached. At the outer end of these plates or arms are swivel fittings on which are mounted annular clamps containing insulators which surround and support the anode rod. The insulators are formed in two halves so that they may be easily installed and clamped in place around the rod. Anode baskets containing chunks or balls of the metal to be deposited are hooked over and supported by the rod. In use the operator lowers the work to be plated into the tank and then, by means of the insulated handle, moves the anode rod to place the anodes in the most advantageous position for the parts being plated. When the plating is completed, the rods are moved apart, the plated parts removed, new ones placed in the tank and the adjustment process repeated. It makes little difference whether one batch is similar to another, and the whole adjustment process requires only seconds.





Designed at Northrop Aircraft for use with a boring bar this tail stock permits reaming to small tolerances at any reasonable distance from the chuck without chatter. It is equipped with four adjustable bearings to accommodate various sizes of boring bars. In the setup shown here the hole in the two hangers are being reamed to size in line. The cutters, which are fastened in the boring bars by means of set screws, are not visible in this view. Back spotfacing, front spotfacing, and radius cutting either forward or back also can be done with this auxiliary tool.





This new punch die for making a hole pattern in the flange of a formed stainless steel supercharge support has halved tooling costs and cut maintenance expenses 94 per cent at the Northrop Aircraft. Three floating pressure pads (see front view) center part and maintain absolute contour for the punching operation. After the pressure pads secure the part, the upper beveled block at rear descends (see side view), actuates corresponding bevel of lower sliding block, and moves it in toward part. Holes are punched by side action of lower block with battery of Wales Strippet punches encased in small springs. The self-contained guide of Strippet punch prevents the punch from striking off center and virtually eliminates punch breakage. In a recent production run of 800 parts, two punches needed replacement.



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B-19 Equipped with 2600 Hp. Engines

INSTALLATION of 2600 hp Allison liquid-cooled aircraft engines with turbo-superchargers and four-blade propellers in the Army Air Forces' XB-19A experimental bomber—said to be the largest in the world—has increased power by about 30 per cent, made high-altitude operation possible, and stepped up speed, range, and carrying capacity. Essentially a flying test laboratory on construction, operation, and performance of large planes, the XB-19A is approximately 50 per cent larger than the B-29 Superfortress in wing span and height and about a third longer. Equipped with four Allison 3420 engines (described in June 15, 1944, issue, pages 48 and 54, of AUTOMOTIVE AND AVIATION INDUSTRIES), the 80-ton plane is designed to carry an 18-ton bomb load or 124 fully armed men.

Modifications of the XB-19, now the XB-19A, were undertaken by Fisher Body Div. of General Motors Corp. at the request of the Army Air Forces. The new design provides four-blade, reversible-pitch, 18-foot Curtiss Electric propellers, which make possible a shorter landing run by providing extra braking power. The new turbosuperchargers with inter-coolers enable the ship to operate at high altitudes. There is an automatic fire extinguisher in each nacelle. The nacelle design has proved so satisfactory that it is being used in another unidentified plane.

Despite the added weight of the superchargers and of the larger propellers, the plane's performance is greatly improved, with speeds in excess of 250 miles per hour and an operating ceiling above 30,000 feet. Top speed with the original 1800 hp radial type engines turning three-blade, 17-ft propellers and with no supercharging was 205 mph, and best operating ceiling was 12,000 ft. In the light of flight test data, radio equipment, the electrical system, auxiliary power plants, hydraulic systems, and brakes also have been modified.

The four 18-foot propellers, which have replaced 16-foot ones used earlier with the Allison engine, are synchronized automatically to the same speed. Use of reverse pitch on inboard propellers is reported to provide braking in landings almost as effective as wheel brakes. Main landing wheels are 96 in. diameter, with the nose wheel 54 in. Basic design of the B-19 goes back ten years, although the ship first flew in 1941. Since that time the Army has been compiling a compendium of test reports on the plane, much of which has been used by American plane manufacturers as a guide to building or redesigning large ships.

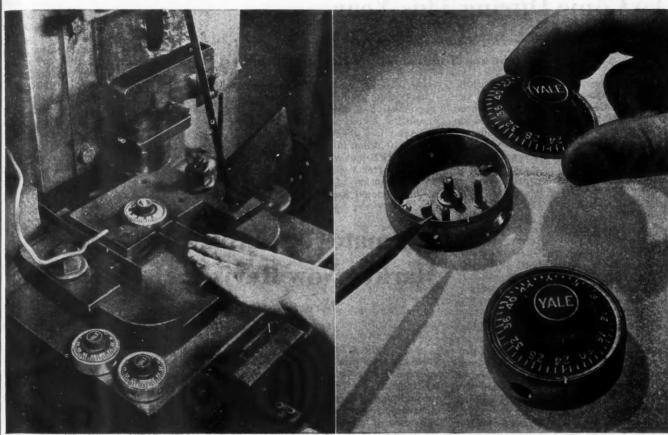
How the B-29 Superfortress Compares with the B-19

	XB-19A	B-29	
Length	132 ft	98 ft	
Wing span	212 ft	141.2 ft	
Height	42 ft	27 ft	
Engine hp	2600 hp	2200 hp	
Top speed	above 250 mph	above 300 mph	
Range	7750 mi	restricted	
Bomb capacity	18 tons	restricted	



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-2 ZINC ALLOY DIE CASTINGS ASSEMBLED BY "CURLING"—AT THE RATE OF 375 AN HOUR!



NOTE: Die cast parts only-interior lock mechanism not shown.

The ductility of zinc alloy die castings was not the determining factor in their adoption for the keyless (combination) padlock shown above. Economy, appearance* and accuracy gave the call to this metal and method of production. But ductility provides a "plus" advantage in the low cost assembly of the lock dial by a simple "curling" operation.

The die cast dial, with a slightly larger sheet metal disk fastened to its under side, is set into the cylindrically shaped die casting which is provided with a shoulder to support the disk. One strike of the punch in a press (above left) and the thin lip of the cylindrical casting is neatly curled over the disk. Thus the disk is locked between the shoulder and the curled-in lip, permitting the dial to be rotated but not pulled out.

Ductility is just one of the many physical and mechanical advantages that make die castings of zinc alloy the most widely used under normal conditions. Every die casting company is equipped to make zinc alloy die castings, and will be glad to discuss their advantages with you—or write to The New Jersey Zinc Company, 160 Front Street, New York 7, New York.

* The clean-cut figures and graduations are cast-in on the dial.

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Greatest Drain on Industry To Come During This Year

The Army Has Gone Back to Its Policy of Safety First—Maximum Mobilization of Men and Supplies

Washington says that 1945 will be one of the most rigorous years of the war. The German military resurgence of the past few weeks has had drastic repercussions all along the production front at home, with emphasis swinging back toward stricter government controls of manpower and materials. The cry now is for greater production of almost all classes of war materials, whereas in the last few months of 1944, there had been a general falling off in some items, such as small arms ammunition, which in some cases had been considered in sufficient supply to warrant closing down plants altogether.

There still are a few military observers who say the German drive is the last desperate effort of a defeated foe and that the end of the war will come sooner because of it. The great preponderance of opinion, however, is that the war in Europe has been prolonged for many months. At any rate, that is the view that WPB has chosen to take as a basis for its production policies. According to J. A. Krug, WPB chief, his agency is proceeding on the basis that the war will continue indefinitely and has plunged into an expanded armament program calling for construction of new facilities costing approximately \$500 million. Some of these facilities will not be in production until late next summer, and if the war should end before that time by some happy circumstance, a large part of the cost would be lost. The Army, too, has gone back to its original policy of safety first—maximum mobilization of men and supplies. All this is bound to have a terrific impact on the national economy here at home.

In the automobile industry, there is some opinion that there will be no new cars built in 1945. Even more noticeable is the reluctance to discuss the effects of the recent military setbacks in Europe on the possible starting time of reconversion. The industry, which has played such an important, role in war production, knows full well that it will be occupied to capacity for a long time on the basis of present commitments and having been criticized once for its efforts to get government action on necessary reconversion measures, it is not surprising that its leaders now are cagey. With the sudden adverse turn of

events, the prospects of returning to unrestricted production of automobiles when V-E day does come are greatly dimmed. A few months back, when the Army had announced a reduction of about \$10 billion in its materiel requirements, WPB had evolved a schedule of cutbacks after V-E day that would permit resumption of car production on an unrestricted basis. However, more recently this has been revised, and cut backs now are said to be contemp ated on a much reduced scale, about 23 per cent as compared with 46 per cen previously. It is reported now that WPB plans to return to its original plan of limited production of cars, possibly two million a year. Of course, i should be remembered that the nation now is in a state of near-hysteria close ly paralleling that of late 1941 and early 1942. If the military situation should fortunately take a turn for the better for any length of time, it is a rea sonable possibility that some of the hard-fisted controls might be relaxed after V-E day. For the present, however, the prospect is for more and more pressure by the government and the military.

Estimates of Cutbacks in Steel Market Now Revised Downward

Directives Based on Conditions of a Few Month Ago Radically Altered to Fit into Present Set-Up

By W. C. Hirsch

In the steel market, estimates of an aggregate of cutbacks of 40 per cent, made before the end-of-the-year breakthrough on the Belgian front, have been revised downward to 25 per cent. This appraisal of conditions in the light of the recent set-back denotes the groping for some sort of yardstick by which the rate of the flow of supplies to the armed forces may be brought into clearer focus. The immediate result of fresh studies of what descriptions of steel are more urgently needed than others has been the intensifying of pressure on mills rolling steel bars, with most of the pressure still ascribed to the impressive increase in the 1945 shell steel program. The pace in plate mills remains about the same. With heavy tonnages of sheets urgently needed for both Army and Navy programs, the desirability of readapting more plate capacity for sheet-rolling again comes in for much consideration. The flow of semi-finished descriptions of steel to finishing mills is the cause of much worry to rolling mill executives. Heavy tonnages of material are needed to fill even part of the requirements of heavy truck manufacturers. Airplane engines are also on the list of equipment that will call for increased tonnages of steel over the remainder of the first half of the current year. Not a few directives, based as they were on conditions of a few months ago, have had to be radically altered to fit into the present set-up. So, for instance, WPB has had to issue a special order to assure a more adequate supply of raw material to electric furnaces, not so long ago considered a relatively minor source of supply. Piecemeal up ward adjustment of steel ceiling prices, as indicated by Washington developments, coming at the present time of unrelieved manpower shortage and unreasonable demands by labor, adds to the market's poor visibility.

Tighter conditions in the supply of a number of non-ferrous metals are predicted by OPA. Lead, which until recently had been considered in comfortable supply, is now on the critical list. A Federal Economic Administration spokesman states that the buying of copper from Canada and Rhodesia has been stepped up because copper can be obtained from these two countries at a lower cost than from any other producing country. Canada is expected w ship to the United States between 30,000 and 40,000 tons of copper in the next three months, this tonnage representing what the British and Canadian authorities estimate will be available after their own needs have been fully covered. Good progress is reported in efforts to overcome the acute labor shortage in Waterbury copper and brass mills through the placing of uniformed service men in specialists' jobs and the importation of several hundred Jamaicans for the heavier brass mill tasks.



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WPB Cuts Truck Output

The War Production Board has cut back the commercial truck program for the first half of 1945 from an original quota of 133,410 units to a revised schedule calling for 120,278 units. Production for the second half will continue at the reduced rate rather than at the rate originally set for the first six months.

In view of the increased pressure of military requirements, WPB officials said, it has been necessary, despite the very urgent needs for commercial trucks, to establish as a basic policy in the production of the 1945 truck program the principle that, in the event

of conflict between the production of military trucks and the commercial trucks, all possible steps shall be taken to see that the military production is accomplished at the expense, when necessary, of non-military programs.

Detroit Engineer Elected SAE President

J. M. Crawford, chief engineer, Chevrolet Div., General Motors Corp., has been elected president of the Society of Automotive Engineers for 1945 at the organization's business meeting held in connection with the SAE 1945 Annual Meeting in Detroit. Mr. Crawford, who becomes president of the SAE in its

40th year, succeeds W. S. James, chied engineer, The Studebaker Corp., South Bend, Ind.

The following SAE vice-president have been elected: Air Transport, William Littlewood, engineering vice president, American Airlines, Inc., La. Guardia Field, N. Y.; Aircraft, J. I. Atwood, executive vice-president, North American Aviation, Inc., Inglewood, Calif.; Aircraft Engine, R. W. Young chief engineer, Wright Aeronautical Corp., Paterson, N. J.; Diesel Engine, W. A. Parrish, executive engineer, Superior Engine Div., National Supply Co., Springfield, Ohio; Fuels and Lubricants, M. O. Teetor, executive engineer, Perfect Circle Co., Hagerstown, Ind. and Passenger Car, A. G. Herreshoft chief research engineer, Chrysler Corp. Detroit.

AIR-

FOR

Passenger-Car Body, W. T. Fishleigh, consulting engineer, Detroit, Production, L. V. Cram, Detroit Diese Engine Div., General Motors Corp. Detroit; Tractor and Farm Machiner, W. F. Strehlow, chief engineer. Tractor Div., West Allis Works, Allis Chalmers Mfg. Co., Milwaukee, Wis. Transportation and Maintenance, E. P. Gohn, chief test engineer, Automotin Transportation Dept., The Atlantic Refining Co., Philadelphia, Pa.; and Trud and Bus, H. A. Flogaus, engineering vice-president, J. G. Brill Co., Philadelphia.

B. B. Bachman, engineering via president, The Autocar Co., Ardmor Pa., has been re-elected treasure New members of the SAE Council will be: J. C. Armer, vice-president, Dominion Forge & Stamping Co., Toronte Canada; F. C. Patton, manager, Lo Angeles Motor Coach Lines, Los Angeles, Calif.; and R. J. S. Piggott, chie engineer, Gulf Research & Development Co., Pittsburgh, Pa.

The 1944 Daniel Guggenheim medifor achievement in design and production of military aircraft was presented to Lawrence D. Bell, president of Bell Aircraft Corp. of Buffalo.

A. W. Herrington, chairman of Mar mon-Herrington Co., Inc., was elected a life member of the SAE.

CALENDAR

Conventions and Meetings

Amer. Soc. for Testing Materials, Pittsburgh Feb.

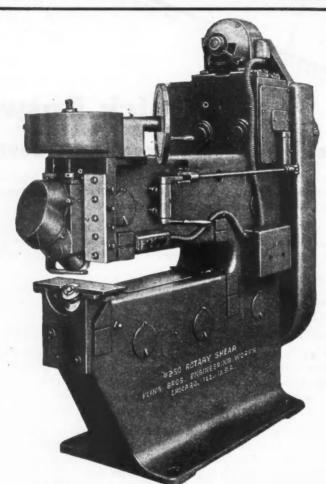
Motor & Equipment Wholesalers Assoc., Annual Meeting, Chicago Mar. 29-5 SAE Aeronautic Meeting, New York

Midwest Power Conf., Chicago April 4d American Foundrymen's Assoc., Detroit April 3d-May SAE Transportation and Maintenance Meeting, Pittsburgh May 3d-Pan - American Aircraft Exposition,

Pan - American Aircraft Exposition,
Dallas, Texas May 20-3
SAE War Materiel Meeting, Detroit
June 4

American Society for Testing Materials, Annual Meeting, Buffalo June 18-2 SAE Tractor Meeting, Milwaukee Sept. 12-5

Jan



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PUBLICATIONS

Rust—Causes and Prevention, is the title of a new booklet published by the Research Staff of E. F. Houghton & Co. It is well illustrated and contains chapters on Corrosion (Rust) Prevention; Cleaning—Needs and Methods; Corrosion Preventive Materials; Choice of Corrosion Preventives; Application; Treatment of Corrosion Preventive Films; Protection of Idle Machinery and Houghton Corrosion Preventives.*

The 3rd edition of the booklet, Work Done on the Blanchard, issued by The Blanchard Machine Co., presents typical examples of the machining and finishing of flat surfaces by Blanchard Grinding. Illustrated and described in the booklet are the various types of grinders, descriptions of work done on automatic grinders, etc.*

of work done on automatic grinders, etc.* Camloc Fastener Corp. of New York has issued two new booklets. The first is a catalog and parts list of the 4002 series aircraft cowl fastener. The second booklet covers Camloc installation procedure on the same series.*

Complete descriptions and illustrations of all Profilometer equipment are included in a new catalog just published by Physicists Research Co. Specifications and prices are given for the Profilometer and its accessories for measuring surface roughness. The catalog also contains four pages of information on the nature of surface roughness and a non-technical description of how the Profilometer measures it for production inspection purposes.*

The Square D Co. has announced the publication of a Fall (1944) edition of the Square D Digest Number 129. It is an abridged catalog containing numerous photographs and listings of products not listed in the previous issue.

A new 12-page, 4-color bulletin, No. ADG-2008, describing the Airco 45 and 45M high speed machine gas cutting tips which control the expansion of cutting oxygen, has been published by Air Reduction. Cross section drawings and photographs show how the especially designed orifices in these tips release a high velocity stream of oxygen to cut a narrower path than the standard cutting tips. Other illustrations, including charts and tables, give valuable specifications data for both model tips.*

A. Schrader's Son has issued Catalog No. 48 on tire valves, tire gauges and accessories. Included are a separate price list and numerical index, tire conservation information; water test data; replaceability feature, the service value of removable replaceable parts, and information on convertible valves. 9

Resistoflex Corp. has announced a new 16-page illustrated catalog of industrial products made from compar, the specially compounded solvent-proof vinyl resin. The properties, characteristics and specifications of each industrial product are contained in the twelve illustrated sections. Under the title Compar, A Remarkable Engineering Material, a question and answer section of the catalog sets forth general information on the high tensile strength of compar. Several pages are devoted to research, development and engineering, with behind-the-scenes photographs depicting how compar products are manufactured and tested.*

National Carbon Co., Inc., has issued Catalog Section M-8000-A, National and Karbate Carbon and Graphite Products. The bulletin describes and illustrates a wide variety of carbon, graphite and Karbate products for use in the chemical, metallurgical, mechanical, electrical and other industries. The products are presented in sequence as applying to each of these industries and many charts and tables cover the physical and chemical properties, together with application and operational data.*

Shell Oil Co. has published the 8th edition of Panorama of Lubrication, The Fun-

damentals of Aviation Engine Lubrication. The illustrated book outlines some specific problems that aircraft engine improvements have posed for the oil industry.*

Ingersoil-Rand Co. has announced the publication of a new 24-page booklet, A Little Air Power Will Do Many a Big Job. The booklet is mainly photographic in format with a miniumum of text. Three pages briefly show models of Type 30 Air-Cooled Compressor and two pages are devoted to a quick summary of the larger Ingersoil-Rand compressors and blowers which range in size up to 3000 hp.*

*Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AULATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

PERSONALS

John B. McClintock, formerly a member of the advertising and sales promotion staff of Frigidaire Div. General Motors Corp., has joined the Creative and Merchandising Dept. of R. L. Polk & Co.

Nick Freeman has been appointed special representative for The Studebaker Export Corp. in the Near East and Balkan territories. He will be attached to the staff of Charles C. Fagan, vice-president in charge of export operations in Africa, Near East and the Balkan states.

John W. Burke has been appointed manager of the Chevrolet commercial and truck dept. to succeed W. E. Fish, recently advanced to the position of assistant general sales manager of the Chevrolet Motor Div., General Motors Corp.

George C. Ford has been appointed works manager for Vultee Field Div., Consolidated Vultee Aircraft Corp. Mr. Ford has been chief of industrial relations since 1943.

The appointment of Richard E. Gould as chief engineer of Aeroproducts Div. of General Motors Corp. has been announced. Mr. Gould, who for the last 14 years has held engineering and executive positions at the Frigidaire Div. of General Motors, succeeds to the position held by Charles S. J. MacNeil, whose death occurred recently.

R. G. Irvine, Jr., has joined Kellett Aircraft Corp. as Material Director in charge of all procurement, material control and stores activities. He was formerly with Republic Aviation Corp.

Arens Controls, Inc., has announced the retirement of Charles A. Arens as president and the election of Calhoun Norton to succeed him as president and general manager.

Commonwealth Aircraft, Inc., has announced the appointment of Ray Shannon as director of Public Relations.

The Metal and Thermit Corp. has announced the election of John B. Tinnon and Waiter S. Smith to the board of directors of the corporation.

J. Hunter Nead has been made manager of the newly established Metallurgical and Inspection Dept. of Inland Steel Co.

J. T. Thompson, Standards Coordinator of the Glenn L. Martin Co., has been elected National Chairman of the National Aircraft Standards Committee of the Aeronautical Chamber of Commerce of America.

Wisconsin Axle Div. of The Timken-Detroit Axle Co, has announced the appointment of Charles A. Cook as assistant to B. W. Keese, Chief Engineer, Mr. Cook will be in in charge of transmission design.

Sherwin-Williams Co. has announced the following personnel changes: Election of Michael J. Fortier as a member of the board of directors and his appointment as vice-president in the capacity of executive assistant to the president, Arthur W. Steudel. Gustave L. Hehl has been named general manager of industrial sales. His position as eastern industrial sales manager

will be filled by Milton A. Kindig, wheadquarters in Newark, N. J.

Mack Trucks, Inc., has announced the appointment of J. E. Savacool, now vio president and comptroller, as a member of the board of directors. Mr. Savacool in been with Mack since 1913.

Stewart-Warner Corp. has announced the promotion of Arden LeFevre as vice-predent and director of engineering, Fred the Cross, advertising manager and George Woehlsen, Jr., assistant director of engineering, Division One of the company (alemba instruments and radio).

R. M. Rowland has been made sales may ager of the central division of the De80 Div. of Chrysler Corp. Douglas M. Herid will continue as head of the expanded western division, and Fred M. Hunt, Philadel phia regional manager, will become sale manager of the eastern division.

Irving S. Babcock has resigned as general manager of General Motors Truck and Coach Div. to become president of Aviating Corporation. Babcock succeeds Victor Emanuel, who has been named chairman of the board and who will continue as Aviation's chief executive officer.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for Auto-MOTIVE AND AVIATION INDUSTRIES

Moderate pre-holiday recession of general business activity was indicated. The New York Times index for the week ended December 23 stands at 139.6, as against 143.2 for the preceding week and 148.2 a year ago.

Electric power production increased moderately during the same period and exceeded the output recorded a year earlier, influenced by a holiday. Since early October, 1944, weekly figures had been somewhat below corresponding production in 1948.

corresponding production in 1943.
Crude oil production in the week ended December 23 averaged 4,729,100 barrels daily, 33,500 barrels above the figure for the preceding week and 7,000 barrels more than the output recommended by the Petroleum Administration for War.

Production of bituminous coal dur-

Production of bituminous coal during the same period is estimated at 10,800,000 net tons, 7.9 per cent above the output a week earlier. Total production thus far shown for 1944 is 5.1 per cent greater than the comparable quantity in 1943.

Engineering construction contracts awarded during the week ended January 4, according to Engineering News-Record, totaled, \$28,809,000, as against \$23,150,000 in the preceding week and \$21,597,000 a year ago. The total last year was \$1,729,758,000, the smallest annual sum since 1935 and 43.5 per cent below the figure for 1948; a decline of 26 per cent. In private construction was accompanied by a drop of 47 per cent in public awards.

The Irving Fisher index of wholesale commodity prices remained in the week ended December 29 at an all-time peak of 114.24 per cent of the 1926 average, as compared with 112.42 at the end of 1943.

Member bank reserve balances increased \$11,000,000 during the week ended December 27, with excess reserves advancing \$100,000,000 to an estimated total of \$1,400,000,000. Aggregate loans and investments of reporting members declined \$144,000,000 in the same period, despite a rise of \$24,000,000 in the total of commercial, industrial and agricultural loans.

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SEALED POWER PISTONS—CYLINDER SLEEVES

January 15, 1945

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Design of the Valiant BT-13

(Continued from page 29)

hydraulic operating cylinders mounted on the front cockpit rudder pedals. Brake-operating pads in the front cockpit are interconnected with similar pads on the rear cockpit rudder pedals by cables.

The tail wheel assembly is of the steerable, self-centering type; it includes a 10-in. wheel and tire of the smooth-contour type mounted on an axle carried by a vertical housing freely hinged to two light alloy yokes which connect the housing and hinge fittings carried by the fuselage structure. Between the fuselage structure and the upper yoke is a shock absorber strut (See Fig. 5).

The detail design of the Valiant was based upon the following factors:

Maximum applied load factors-positive, 5.67; negative, 2.33.

Applied gust factors—positive, 3.65; negative, 2.05.

Maximum applied landing factors (ground landings)—gross weight 4498 lb; factor, 4.

Limited applied diving speed-217 mph or 130 per cent high speed (Airplane is stressed for a 229 mph dive)

Propeller

The power plant may utilize either; compreg wood or metal bladed Hamilton Standard propeller. In either case, is a two-position propeller with two blades and a diameter of nine ft. When metal blades are used, the maximum pitch limits are 18.5 deg (high) and 12.5 deg (low). If compreg wood blades are used, the maximum pitch limits are 19.6 deg (high) and 13.5 deg (low). In a level landing, the blades have a minimum clearance above th ground of 9.0 in.

Oil System

The engine lubrication system consists of an oil tank, oil cooler with thermostatic relief valve, and suitable connecting lines. The welded aluminum-alloy sheet tank will carry as proximately 10.9 U.S. (9 Imperial) gallons with additional "foaming space" equal to about 1.09 U.S. (.9 Imperial) gallons. The 7-in. diameter oil coole is situated in the engine accessory compartment. The oil dilution system is electrically-controlled from the from cockpit only on later models; manually operated on earlier models.

Fuel System

The fuel system includes two integral tanks with a total capacity of ap proximately 120 U.S. (103 Imperial) gallons, one situated on each side of the wing center section. A standpipe is provided at the outlet connection of the right-hand fuel tank, so as to trap a reserve fuel supply of approximately 17 U. S. (14 Imperial) gallons which may be drawn upon by setting the fuel cock to the "reserve" position. Also, one fuel cock is provided, controllable from both cockpits, to permit fuel to be drawn selectively from either tank

The fuel unit contains a strainer, water trap, water drain cock, and a emergency fuel pump which is op eratable from either cockpit for starting or supplying fuel to the engine i emergencies. In addition, there is a pressure relief valve to regulate the pressure delivered by the emergent fuel pump.

Half-inch diameter aluminum-allo tubing comprises the fuel line between the carburetor and fuel pump. All additional fuel lines consist of % in diameter aluminum-alloy tubing.

Foremost problem encountered is producing the Valiant was involved in the prevention and repair of fuel tank leaks, due to undesirable flight evolutions and rough landings made by student pilots. Since it is virtually im possible to construct an efficient light airplane that will withstand such treat ment, and since most leaks develop the corners of integral fuel tanks, Convair engineers developed an ingeniou method for sealing the BT-13 tanks. It consists of drilling a small hole through the outside wing skin into a lateral

(Turn to page 48, please)



by treating your gasoline with

LUBRI-GAS

there's NOTHING else like it!

No mechanical system has ever been invented that assures constant, ade. quate lubrication of valves, guides, upper cylinder, pistons, rings. That is why sticky valves, burned and pitted valve seats, worn rings, and carbon and gum accumulations in upper cylinder are usually the first symptoms of motor trouble. Lubri-Gas Laboratories have developed an exclusive method of chemically processing 40 SAE lubricating oil, so that it enters the combustion chamber, through the carburetor, as an oil fog, and coats all upper cylinder parts with a film of clean oil. The results of this better lubrication are more power, more mileage per gallon, more pep, less wear and repair, freedom from carbon and gum and prevention of overheating and oil pumping. Now when it is so important to keep equipment in operation and out of the repair shop, LUBRI-GAS is indeed a God-send!



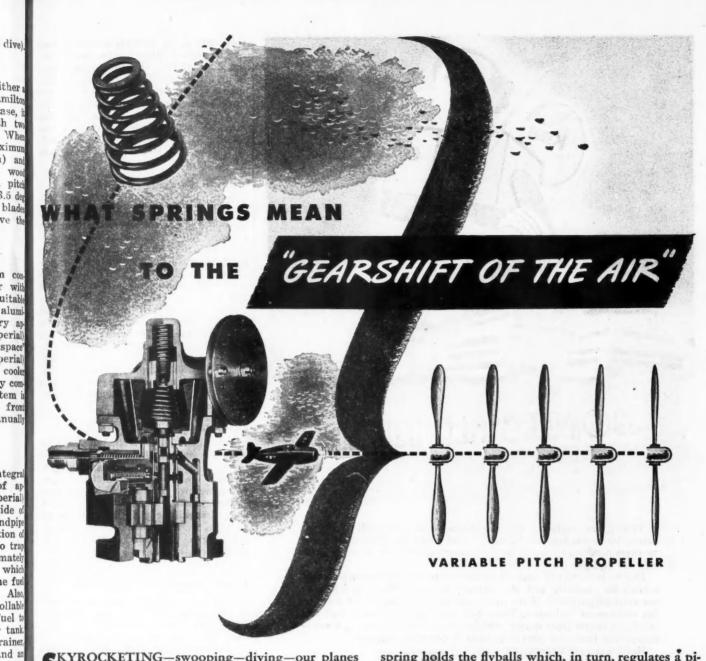
Send for Free Lubri-Gas File. Contains complete information about this modern motor fuel treatment.

LUBRI-GAS Chicago 1, III.

221 No. LaSalle St.



Cleans and Lubricates as It Powers the Motor



SKYROCKETING—swooping—diving—our planes are driving the enemies dizzy on every front. And one of the main reasons for U. S. air supremacy is the constant-speed propeller—controlled by the Woodward Hydraulic Governor. This maintains a constant engine speed by operating the pitch-changing mechanism of the propeller.

Muchlhausen Springs are responsible, too—for they are important parts of the governor. In the illustration above, note particularly the cone-shaped compression spring located at the top center. The tension of this

spring holds the flyballs which, in turn, regulates a pilot valve controlling hydraulic pressure to propeller.

All springs used in this governor are made to tolerances measured in thousandths of an inch, and designed to compress squarely under all degrees of loading. Typical examples of the unvarying precision demanded in the design, fabrication, and testing of Muehlhausen Springs. Send for Die Spring Folder.

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January 15, 1945

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Throughout industry and the Armed Forces as well as in the home, housekeeping has become a real problem. With competent workers harder and harder to find, cleaning must be done by more efficient equipment.

In a wide variety of manufacturing plants and maintenance shops—both for industry and the military services—Kerrick Kleaners are saving up to 80% of the manhours normally required for cleaning equipment and parts. These efficient cleaners remove dirt and stubborn grease from motor vehicles, airplanes, machinery, floors—everything from tiny precision parts to complete factories.

Heat, water, detergent and friction are scientifically combined in Kerrick Kleaners to remove dirt from all types of surfaces...faster, better and cheaper.

Kerrick Kleaners had years of successful experience in automotive and industrial cleaning to get ready for their present war assignments. They will again be available, in stationary and portable models, for most efficient steam cleaning.

Other Clayton products serving the Armed Forces include: Flash Type Steam Generators—Hydraulic Dynamometers—Hydraulic Liquid Control Valves—Boring Bar Holders and Boring Bars.



This illustration shows portable Model L-OEP

MANUFACTURING CO. ALHAMBRA CALIFORNIA

longitudinal, or vertical tunnel formed by the corner fittings, and then injecting Thiokol into the tunnel by means of an air gun. Chief advantage of this procedure is that the fuel tank does not have to be drained in making the repair; therefore, the entire operation may be accomplished within a few minutes. The injected Thiokol seals both the drill hole and and the leak (See Fig. 6).

Engine Controls

Both cockpits are provided with throttle, mixture and propeller controls (See Fig. 7). Carburetor air heat and priming pump controls are situated in the front cockpit only. The throttle, mixture, and propeller controls are provided in the form of one Type B-24 engine control unit in the front cockpit and one Type B-21 engine control unit in the rear cockpit; they are mounted on sheet metal brackets, secured to the left side fuselage structure (See Figs. 8 and 10). The carburetor heat control lever is mounted in the front cockpit on a quadrant placed below the engine control unit. All engine controls comprise individual systems of pushpull rods and bellcranks.

Instruments

A vacuum pump is installed on the accessory case at the rear of the engine for the operation of gyroscopic instruments. One 24-volt, 50 ampere, Type M-3 generator is mounted on the engine accessory case; it is provided with a voltage regulator and a current control switch. In the right forward face of the engine firewall, near the airplane's centerline, is a 24-volt battery (Type G-1).

Communications Equipment

Radio equipment includes a command set, interphone, RC-198 filter unit, and a marker beacon receiver. The controls for all these items are mounted on the right side of the front cockpit. Interphone and receiver tuning controls only are situated on the right side of the rear cockpit. Two antennas are provided; one is of the fixed-wire longitudinal type, while the other is stretched along the lower right surface of the monocoque for use with the marker beacon receiver.

No Immediate Prospect Of Used Car Rationing

Special investigations made in Washington by the National Automobile Dealers Association indicate that rationing of used cars is not an immediate possibility. OPA, which is charged with that task, drafted such an order several months ago, but has discarded the idea.

It also is a possibility, according to the report, that if the war is protracted long enough, unessential cars may have to be acquired through some kind of requisitioning order, but here again ODT will move only under pressure of the greatest necessity.

Ja



Gear tooth hardness need no longer be a compromise between machinability and wear resistance. Red Ring Rotary Gear Shaving as the final machining operation on the green gear, during which approximately .001" of stock is removed from the tooth surfaces, corrects cutting errors of index, helical angle, tooth profile, eccentricity and undesirable tooth roughness.

This corrected gear may then be induction hardened to whatever surface hardness is desired and without objectionable distortion. Hardening without detrimental distortion is frequently accomplished on gears carburized after shaving by quenching in dies and sometimes by liquid carburizing and quenching without dies. No grinding of tooth profile is necessary.

On a 5.145" P.D. gear so treated, final involute error is held to between +.00015" and -.00015"; parallelism to .0002"; tooth spacing to .0001" to .0002"; and accumulated error to .0008".

WRITE FOR DESCRIPTIVE FOLDER



Specialists on spur and helical involute gear practice
Originators of rotary shaving and elliptoid tooth forms

NATIONAL BROACH AND MACHINE CO.

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DeSoto's B-29 Sub-Assembly Pool

(Continued from page 24)

ability without special fitting. Each department is equipped with the necessary fixtures to facilitate the integration of sub-assemblies from one stage to another until the section is in completed form. Straight-line production methods, stemming from automotive practice, prevail throughout. For example, portable resistance welders and controlled cycle resistance welding machines are spotted in every department at the point where the welding operation is to be performed. Portable tools

for drilling, for riveting, for dimpling, etc., are either of pneumatic or high cycle electric type, distributed at the various stations.

Welding is a major process in most departments. There is a tremendous array of portable gun welders, with overhead-mounted transformers, grouped about framing fixtures for initial welding and tacking operations. Much of the final spot-welding is done on resistance welding machines of several familiar makes, including several seam welders of advanced type. Welding is done on aluminum as well stainless steel. To maintain an effect tive control of critical welding open tions, DeSoto has a special welding con trol department whose function it is maintain a constant watch on the equipment and its performance. The group is equipped with portable tes ing devices for checking both quality and machine performance.

One of the departments is set up for the fabrication of the carburetor elbo assembly. This is composed of a aluminum base casting to which are welded a large number of individu aluminum stampings. The pieces ar assembled in a welding positioner and joined by oxy-acetylene torch welding Following welding, the unit is shipped to the Plymouth Division for machining of the base.

The air duct, which is assembled into the engine cowling, is produced in an other of the self-contained departments being integrated in a multiplicity steps by the welding and riveting many stampings. This unit combine both aluminum and stainless stee

pieces.

A relatively large portion of the flo area is devoted to a group of depart ments producing the sub-assemblies and the final assembly of the engine cowl Most of the cowl is of stainless steel This important section has been skilfully sub-divided into its major ele ments so as to facilitate straight line production methods. The #20 an #40 rings or bulkheads are prepared in individual departments, being built u from stainless steel stampings in spe cial fixtures. The nose ring-forward outer section of the sub-assembly-composed of both aluminum and stain less steel stampings and formations is assembled in its own department.

These sub-assemblies, after comple tion, are brought together in the final installation department where the weld ing and riveting is done while the work is rigidly aligned in special framing fixtures.

Cowl flaps and removable panels are assembled in their own department These are in the nature of small doors made up of inner and outer sections with stiffness in between. They are produced in successive steps by spot welding, then by seam welding for pres sure tightness. An interesting feature of this department is the arrangemen for the progressive welding of flaps utilizing a wide belt conveyor for feel ing work from one welding machine another, the machine being arranged of both sides of the conveyor.

Since the B-29 has pressurized see tions, one of the major quality control jobs is checking for pressure of the completed nose section before it is de livered to the installation line. The requirement of pressure tightness impost a severe burden on the assembly link thereby distinguishing the B-29 from conventional airframe assemblies. Al door openings are precision fitted and all riveted joints are sealed to prevent





TRIES January 15, 1945

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Vew Production Equipment

tinuous wheel feed can be furnished Work speeds are from 100 to 1000 rpm. Grinding wheels 16 in, in diameter and up to 3 in. wide are available for this machine. Other features include Nor.

Norton Company, Worcester, Mass., has added a new 4-in. Type C cylindrical grinder to its line of grinding and lapping machines. Available in 12-in, and 18-in, lengths, this machine is primarily designed for short-length, small-diameter work.

This grinder has many features. Hy-

draulic table traverse, automatic infeed of the wheel at each table reversal and adjustable dwell at each end of the table traverse are standard arrangements. The machine is available as plain or semiautomatic with manual or automatic cycle. Where a semiautomatic machine is desired, con-



The maximum floor space occupied by the longer machine is approximately % in. long by 55 in. wide.

ton wheel spindle with automatic lubrication and automatic coolant controls,

A SPECIAL-PURPOSE, two-position, multiple tapping machine has been designed and built by Snyder Tool & En-

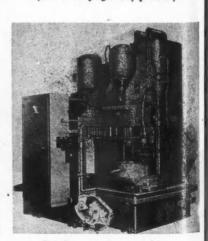
gineering Co., Detroit, Mich., for use on a large aircraft part.

The part is loaded and manually clamped in a fixture which is on a hydraulic sliding table. In the first working position there is a vertical tapping unit and an angular tapping unit, each equipped with multiple heads and tapping spindles with individual lead screws. To facilitate loading, the vertical head and unit are hydraulically lifted upward and out of the way. In the second working position, there is a vertical multiple head for tapping and a single spindle angular tapping unit All spindles have individual lead screws.

The machine is semi-automatic. With the part loaded and clamped, the vertical head is moved into position hydraulically and both vertical and angular heads tap a series of holes. The verti-



(Turn to page 54, please)



Snyder tapping machine

Ohio

Jan

E-N-G-I-N-E-E-R-E-D To Fit YOUR Product



For over a quarter century we have been making clutches of all kinds. This clutch building experience has developed a specialized engineering service of value to manufacturers whose product designs require special clutch applications. It is a good idea to use standard clutches, where practical, but if your need is out of the ordinary, it will pay you to get the recommendations of our power transmission engineers regarding the clutch which will meet your specifications exactly.

SEND FOR THIS HANDY BULLETIN ON POWER TRANSMISSION

It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications. Every production engineer will find help in this handy bulletin, when planning postwar products.

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expanded, cold drawn, fluted, flattened, bent, coiled, upset, beaded, grooved, rolled, spun, threaded, tapered, and shaped to meet every manufacturing demand.

Available in commercial mill lengths or cut to specified lengths. shaped and fabricated, ready for assembly.

> Engineering advice and technical help in the selection of tubing best suited to meet your needs.

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January 15, 1945

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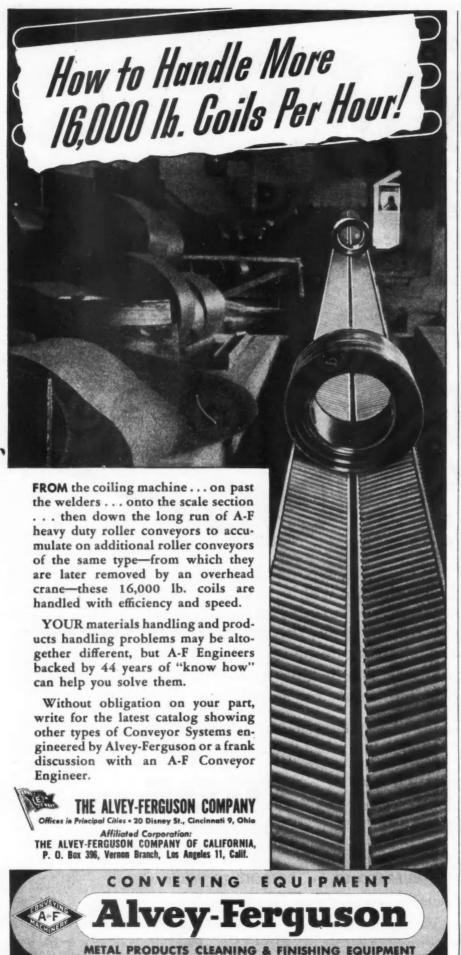
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cal head then returns to rear position and the part automatically moves in second working position, at which point the vertical and horizontal heads go through in the tapping cycle. When the taps have retracted, the fixture and slide automatically return to the loading station and the part is finished.

All lead screw tapping spindles are equipped with safety spindle ends and floating tap holders. This protects the tap from being broken and the work piece from being spoiled.

THE Electronic Piston Ring Inspector has been designed by the Sheffield Corporation, Dayton, Ohio, to eliminate the human element in checking piston rings. The instrument automatically inspects the trueness of periphery and the width of gap of a specific size of piston ring. The piston ring to be checked is inserted inside a master ring of correct dimensional quality which is placed on the instrument table and rolling to the correct dimensional quality which is placed on the instrument table and rolling to the correct dimensional quality which is placed on the instrument table and rolling the same results of the correct dimensional quality which is placed on the instrument table and rolling the correct dimensional quality which is placed on the instrument table and rolling the correct dimensional quality which is placed on the instrument table and rolling the correct dimensional quality which is placed to the c



Sheffield Electronic Piston Ring Inspector

tated by a power-driven roller. The gaging functions are performed by scanning beams of light directed on photo-electric cells which energize electronic circuits to illuminate three signal lights.

Master piston rings of known dimensional quality are used in adjusting the instrument for the desired tolerance. The instrument can be adapted to various nominal sizes, gaps of varying width, and also for variations on the allowable out-of-roundness of the periphery. Trueness of the periphery can be determined within a tolerance of .0001 in.

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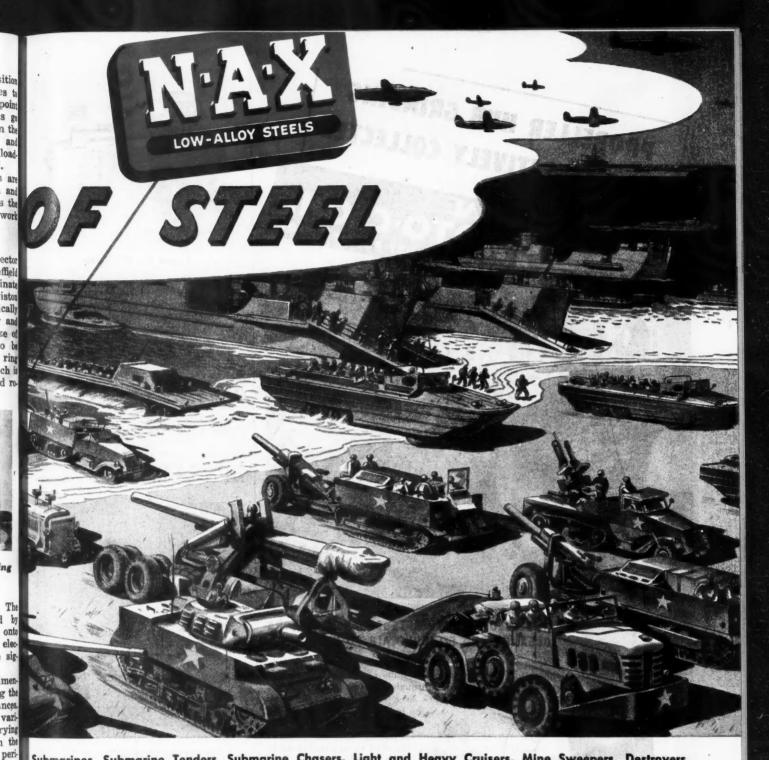
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THE Logan No. 825 lathe, made by Logan Engineering Co., Chicago, Ill, combines all of the features of the company's standard quick change gear lathe with a compact cabinet. The carriage with friction feed automatic apron travels over a bed that is ground to within .0005 in. of absolute accuracy. Total run-out of its headstock spindle 12 in. from the bearings is less than .001 in. The lead screw is held to with in .002 in. in 12 in. The spindle turns on a double row of preloaded precision ball bearings, and at 40 other vital points friction is minimized by self lubricating bronze bearings. All moving parts and gears are completely en-

(Turn to page 58, please)



Submarines, Submarine Tenders, Submarine Chasers, Light and Heavy Cruisers, Mine Sweepers, Destroyers, Destroyer Escorts, Patrol Craft, PTs, Battleships . . . Anti-Aircraft and Artillery—.50-Caliber Machine Gun Mounts, 40-mm. Bofors, 75-mm., 90-mm., 105-mm. and 155-mm. Gun and/or Howitzer Mounts and Carriages, Armor Gun Shields . . . Aircraft, from Fighters to Bombers — Armor, Oxygen Supply Cylinders, Landing Wheels, Brake Drums and Frames, Superchargers, Bearings, Tools . . . Miscellaneous Applications—Aerial Torpedoes, Demolition Bombs, Flame Throwers, Diesel Engines, Cable Reels, Pontoons, Land Mines, Ammunition Boxes and Others.

Out of America's great manufacturing industries out of the coordinated teamwork of engineers, technicians, metallurgists, material processors and production men—has come the mechanized might that will crush the Axis. It is an *onslaught of* steel, launched against the enemy by fighting men whose skill and courage make victory inevitable.

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Much of the steel that goes into this fighting equipment flows from the mills of the Great Lakes Steel Corporation: N-A-X High-Tensile Steel for highly stressed structural parts and members subject to fatigue and impact—N-A-X 9100 Series Steels for constructional parts—N-A-X Armorblate for rugged armored equipment of all types. From the earliest tanks built, to the recently announced Staghound, armored with N-A-X Armor-

plate exclusively, Great Lakes Steel Corporation has played a vital role in supplying our land, sea and air forces.

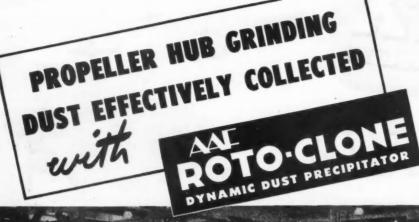
Proved in the stern test of battle, N-A-X Alloy Steels will speed reconversion—lend new strength, lightness and durability to postwar products.



Corporation

N-A-X ALLOY DIVISION

UNIT OF NATIONAL STEEL CORPORATION





ROTO-CLONES WITH AFTERCLEANERS RETURN CLEANED AND FILTERED AIR TO WORKROOM

None of the dust from the final grinding operations on the inside of these propeller hubs escapes collection - it is all drawn down through the Roto-Clone collector pipes over the openings of which the hubs fit snugly.

A feature of this installation is that the air used to collect the dust is returned clean to the workroom, through viscous filter after cleaners mounted directly on the Roto-Clones. The atmosphere of the workroom stays clean and room temperatures and workers' visibility, comfort and efficiency are unaffected by any process dust. Only extremely compact, efficient Roto-Clones make possible dust collector ar-

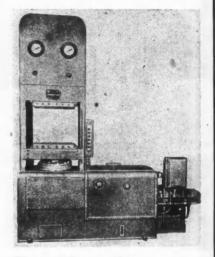
rangements like this one. Roto-Clone is a combined dust collector and precipitator requiring minimum floor space. Installation is simple and operating costs are extremely low. Roto-Clones are available in a wide range of sizes for the collection of all types of process dust. Send for Bulletin 272.



Logan No. 825 lathe

closed. The power plant and under-neath drive are enclosed in the left compartment of the four-drawer, stipple finish gray steel cabinet. A multiple V-belt drive transmits power from cone pulley to spindle. Adjustments of both flat and V-belt tensions are easily accessible to the operator.

THE Watson-Stillman Company, Roselle, N. J., has brought out a hydraulic molding press containing a top transfer cylinder and two rams. It has an upward operating ram with a capacity of 100 tons for general molding and a downward operating 30-ton ram for transfer molding at pressures



Watson-Stillman 100-ton molding press

of 6-30 tons. The pressure is supplied by two pumps, one for maintaining pressure on the main ram, the other a high-and-low variable delivery pump driven by a 71/2-hp motor. There are separate pressure and inching handwheel controls for both cylinders, controlled by push buttons through solenoid-controlled operating valves.

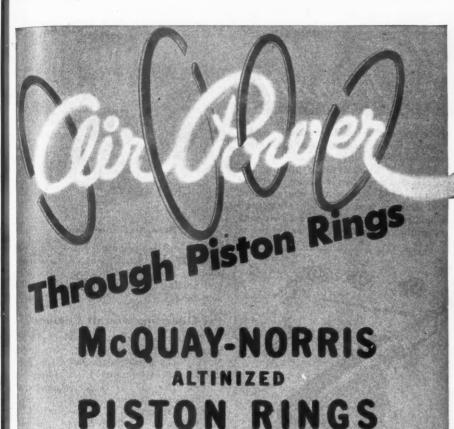
C. ALLEN FULMER Co., Cincinnati, Ohio, is offering a honing machine which is said to produce straight, round, smooth bores to working tolerances as small as .0002 in. The Fulmer honing machine can be supplied in various working stroke lengths up to 72 in., and with cylinder honing capacities up to 20 in. in inside diameters.

(Turn to page 202, please)

Close-up of Type D Roto-Clone with Aftercleaner. Diagram shows how propeller hub fits into specially formed end of dust col-lection pipe, which comes up into the base of the grinding table.

AMERICAN AIR FILTER CO., INC.

449 Central Avenue, Louisville 8, Kentucky In Canada: Darling Brothers, Ltd., Montreal



PISTONS...PINS...
HARDENED AND GROUND PARTS

McQuay-Norris is definitely air-minded. We are now suppliers of precision parts to the world's largest makers of aircraft motors. Our 34 years' experience in precision manufacture enables us to meet every demand of modern aviation for sturdy, unfailing precision parts. Your inquiries are invited.



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New Products for Aircraft

Stainless Steel Hose Clamps

New all-stainless steel Aero seal hose clamps, designed for service where conditions require highest corrosion resistance, are now in production at the Aircraft Standard Parts Co., Rockford, Ill. At present production is in only the most popular sizes-M12, M16 and

SAVE 50%

ASSEMBLY

TIME!

M20-but the line will gradually be increased to include all nominal sizes from 1/2 in. through 41/4 in.

Although lighter and thinner, the stainless steel bands have greater strength and flexibility than carbon steel clamps, and have the advantage of being made entirely of rust-resistant material. A new mechanically inter-

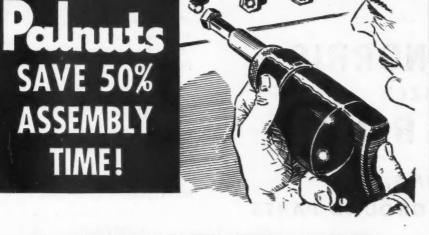


Aero Seal hose clamp

locked saddle permits elimination of welds at that vital point. As a consequence of these features, durability and holding power are increased in the new model.

Pre-Oiler for Aircraft Engines

The Durham pre-oiler, made by Durham Aircraft Service, Inc., Flushing, N. Y., is designed especially for preoiling aircraft upon installation in planes. The oil container consists of double compartments. The inner vessel contains 48 quarts of pure lubricating oil which is preheated and pumped under pressure throughout the entire engine. The outer vessel contains 18 gallons of high flash oil which is elec-



NO LOCKWASHERS NEEDED WHEN YOU FASTEN WITH SELF-LOCKING PALNUTS

Self-locking PALNUTS provide vibrationproof assemblies with big savings in time, labor and cost. Because it locks as it tightens, a single PALNUT replaces a regular nut and lockwasher. Speedier assembly is thus possible because one part is handled instead of two-and power or Yankee drivers may be used.

PALNUTS are single thread nuts, made of tempered spring steel. They cost much less than nut and lockwasher combination. Many types for various applications, in a wide range of standard sizes.

Send details of assembly for samples and data. Write for Palnut Manual No. 2, which gives full details.

The Palnut Co., 60 Cordier St., Irvington 11, N. J.

USED ON Engine Coil Mounting - Choke and Throttle Dash Mountings-Instrument Assembly - Instrument Cluster - License Bracket-Moulding Strips-Radiator and Trunk Medallions-Glove Compartments-etc.

DOUBLE LOCKING ACTION



When the Palnut is tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the part (A-A), securely locking both.



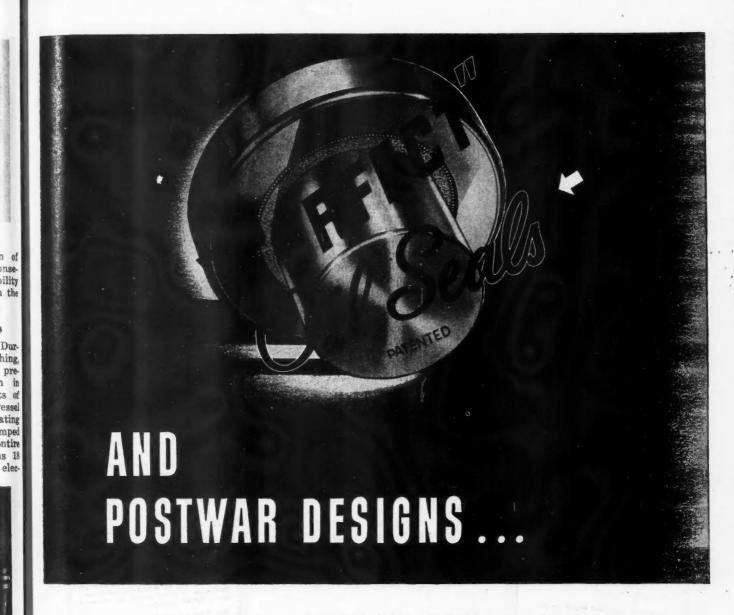
Durham pre-oiler

trically heated. The heat is conducted through to the oil in the inner chamber.

A circulating pump of the rotary geared type with helical gears delivers approximately 5 gpm at 100 psi. The pump is driven by a 1-hp, 3 phase, @ cycle, 208/220 volt, 1720 r.p.m. electric motor. The pump and motor are connected through a flexible coupling. The entire unit is mounted on its individual base, which is bolted to the pre-oiler assembly. This individual base mount

(Turn to page 62, please)





Manufacturers, to succeed in the postwar machinery and metal appliance markets, will have to establish high quality standards and at the same time keep production costs at the very minimum. Adequate bearing protection is essential in all high quality mechanical products. When this is achieved through the use of "Perfect" Oil Seals, the second requirement is also satisfied—low cost production. Therefore oil Seals retain the vital lubricant in bearings and at the same time exclude the bearings' worst enemies, grit and moisture. "Perfect" Oil Seals are inexpensive and easy to apply. Consult Chicago Rawhide engineers on your postwar designs NOW.

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LUBRICATION IS INDUSTRY'S ESSENTIAL PRIME



The "all-out" production of the war period has not only proven the importance of proper lubrication but has effectively demonstrated the superiority of LUBRIPLATE Lubricants. Even the most confirmed skeptic must admit that when two surfaces do not touch, there can be no appreciable wear. The separating film of LUBRIPLATE is tougher. That is why LUBRIPLATE Lubricants impart longer life to shafts, bearings, and gears. LUBRI-PLATE has qualities not possessed by conventional lubricants

LUBRIPLATE

Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRI-PLATE arrests progressive wear.

LUBRIPLATE

Lubricants protect machine parts against the destructive action of rust and corresion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE

Lubricants are extremely economical for reason that they possess very long life and "stayput" properties. A little LUBRI-PLATE goes a long way.

Write for a booklet, "The LUBRIPLATE Film", written especially for your industry.



ing allows for easy removal from the unit for testing, or for auxiliary service wherever a dependable oil pump is required.

Absolute Altimeter

An absolute altimeter now in successful use, tells the pilot how far the plane is above a mountainside or other unseen obstacle at night, during fogs, and in storms.

The absolute altimeter based on radio principles, is a development of engineers of several organizations, including RCA and the Navy. The system requires a special instrument developed by Westinghouse. It is a highly accurate d-c millimeter of the circularscale type and is fully temperature compensated to operate at temperatures from -67 F. to 18 F. Over the normal range of temperature the accuracy is within one per cent. The instrument has two scales, 0 to 400 ft., and 0 to 4000 ft., selected by turning an external switch. Only one scale shows at a time behind the windows in the dial face, thus eliminating any possibility of error by the pilot reading the wrong scale. The instrument, necessarily made as light as possible because of its use in planes, also combines the master control switch for the entire absolutealtimeter system.

Unlike previous altimeters, which gave only an indication of altitude above sea level, the absolute altimeter provides information as to the distance to the nearest solid object, be it the ground beneath or a hillside or mountain. Furthermore, for distances within the region of 10 to 400 ft, this indication is said to be accurate to within five feet of the actual distance.

Electronic Cabin Temperature Control System for Aircraft

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has developed a completely automatic electronic cabin temperature control system for aircraft.

The new control system is a package unit weighing slightly under eight pounds and is designed to hold autocabin temperature matically any selected by the pilot.

(Turn to page 70, please)



Minneapolis - Honeywell tem perature regulator

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THERE IS A LUBRIPLATE PRODUCT FOR YOUR EVERY NEED

LUBRIPLATE represents one of the most important advancements in lubrication in many years. It possesses characteristics not found in conventional lubricants. In addition to superior lubricating qualities it prevents rust and corresion. The adoption of LUBRIPLATE by practically all im-portant industries and the Army and avy is indeed a record of achievement. LUBRIPLATE is available in a number of fluid and non-fluid densities to meet every operating condition.

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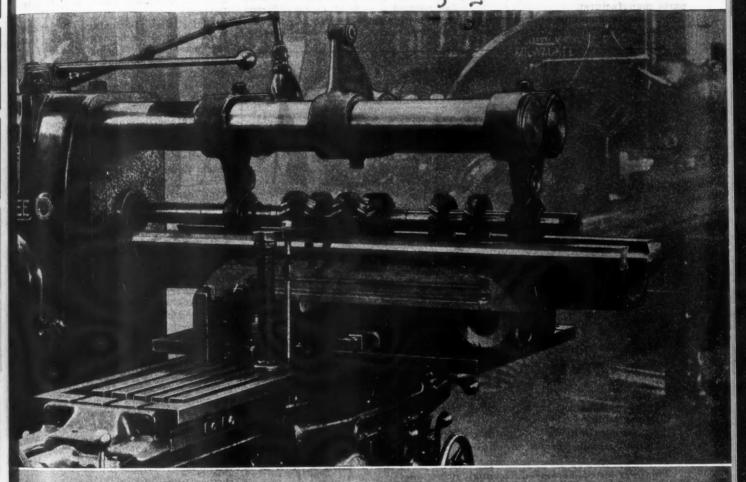


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Five side-milling cutters and one pair of interlocking side-milling cutters are mounted on a special 51-1/2842 Milwaukee Arbor held in the spindle of a Milwaukee Arbor held in the spindle of the spindle of

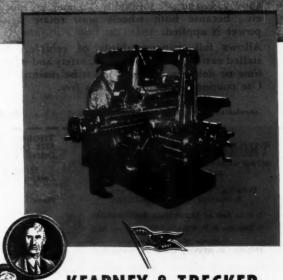
braces support the arbor while a third increases overarm rigidity. Seven faces are straddle milled simultaneously in this set-up in which the knee is fed vertically.

Taking the tough jobs in stride — setting the pace in production milling — standing up with precision performance through the years — these qualities have made "Milwaukee" a top ranking name in milling machines.

Their ability to crack many a milling problem is reflected in the popular expression of machine tool men—"put it on a Milwaukee." Time-tested, production-proved, modern in every detail of design and construction but free of frills and novelties Milwaukee Milling Machines yield the sustained performance — with precision and speed — that spell profit in milling operations.

Select your milling equipment from the Milwaukee line of more than 70 models — the PoweRated Milling Machines — every machine engineered and built with ample power for every class of job.

Milwaukee Machine Tools



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The Army's Spare Part Policy

(Continued from page 17)

4. That procurement officers should not rely upon taxes and renegotiation to cover up failure to make a good bargain for the Government in the first place, buying of spare parts should be more direct, eliminating middlemen's profits and unnecessary transportation and handling. In automotive parts, the additional cost of such indirect buying is almost 50 per cent of the price which the end item manufacturer pays the parts manufacturer.

5. That the handling of transportation and warehousing be improved, and that inventory and stock control . . . and the liaison between offices stating military requirements, offices in charge of inventories, and procurement offices must be improved.

In its discussion of standardized specifications, the report cites the progress made by Army Ordnance in simplifying bearing identification as an example of what can be done. From its interchangeability study, Ordnance has reduced a total of 17,000 different identification numbers for motor vehicle bearings to 1500 numbers, thereby

minimizing procurement, paper work, and physical handling, and increasing usefulness.

The Army officers present at the November hearings told the committee that the national stock of parts is surveyed every three months, but did not present any of the findings of the surveys. The officers included Brig. Gen. Walter P. Boatwright, Commanding General, Office Chief of Ordnance, Detroit; Brig. Gen. A. B. Quinton, Chief of the Detroit Ordnance District; and Brig. Gen. John K. Christmas, Deputy Chief of the Office, Chief of Ordnance, Detroit.

Under the questioning of Senator Mead, General Christmas admitted that surpluses are not being declared as rapidly as possible, but stated that this was due to a desire on the part of the Army to have sufficient quantities on hand at all times to meet any emergencies. The Ordnance officers claimed that any over-buying was largely due to inexperience in handling large-scale procurements. It is the committee contention that such inexperience should have been overcome by now.

Pushing the point that parts were being bought in excessive quantities, Assistant Committee Counsel George Meader revealed that the Army had procured 2,198,983 combat and transport vehicles up to Jan. 31, 1944, and had increased this total to 2,698,594 vehicles as of July 31, 1944. During 1943 the Army had purchased \$1,374,750,000 worth of concurrent and replacement parts and expects to purchase about \$1,160,000,000 worth during 1944.

He further pointed out that in the peak civilian year a little more than \$600,000,000 (Editor's Note: A check showed the actual figure to be \$718,012,295) was spent for replacement parts to service approximately 30,000,000 civilian vehicles then in operation. Proportionately this results in about 30 times more parts being used by the Army per vehicle than were consumed by the civilian population in the peak peacetime year, according to Mr. Meader

General Boatwright, attempting to refute Mr. Meader's claim, said that about 40 per cent of all Army vehicles are sent overseas under Lend-Lease and a year's supply of parts accompany each vehicle. Additional parts are requisitioned later by the respective Lend-Lease recipients. Vehicles sent overseas for use by the Army are not equipped with a year's supply of replacement parts.

General Boatwright then presented the following figures, which were brought out to uphold the Army's position on overbuying:

Army Ordnance Transport Vehicles

Percentage of Vehicle Value Vehicle Parts in Parts Value Purchased Purchased 1943 \$3,086,000,000 \$528,000,000 17 per cent Civilian Car, Bus and Truck 1941 \$8,637,000,000 \$718,000,000 \$ per cent (Turn to page 66, please)



The THORNTON Automatic-Locking DIFFERENTIAL

—greatest advance in differential design—is now available to truck owners who must keep their vehicles moving . . pulling on through extremely tough surface conditions the year 'round.

This war-tested Locking differential stops one wheel spin which normally stalls a vehicle in snow...sand...soft fields...mud...muck, etc., because both wheels must rotate when power is applied.

Allows full maneuverability of vehicle. Installed easily on trucks for pull, safety and where time or delivery schedules must be maintained. Use coupon to obtain full facts free.



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80% of the New England fishing fleet boats have Lister-Blackstone auxiliary Diesel engines. This rugged engine is made still more reliable by having Porus-Krome liners in its cylinders . . . a standard specification for every Lister-Blackstone engine.

Porus-Krome resists both corrosion and abrasion and multiplies cylinder life from 4 to 20 times. Its porosity assures better lubrication, too. These characteristics are especially needed where the engines "run cold" as they do in fishing boats . . . and in other engines, too, which are used in cold weather.

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He said the reasons for the Army purchasing twice as many parts as required for civilian upkeep, rather than 30 times as many as was contended by the committee, are as follows:

1. Army off-highway operations in different theaters of war under all weather conditions.

2. Field maintenance with limited tools, time and skill.

3. Parts stockage requirements for 1000 Army supply and maintenance depots with important operational differences.

4. Procurement of requirements many months in advance because of manpower shortages, packing and transportation difficulties, etc.

General Christmas, who had recently completed a tour of overseas Ordnance installations, said that he found no general shortage of parts overseas, but that there are specific shortages because of transportation and distribution difficulties and the fact that the country is scraping the bottom of the barrel in regard to some types of parts, particularly those requiring castings.

He also said that he found no wastage of parts and that vehicles were not sent back from overseas for parts failure. They are repaired by the Army and the cost is charged back to the manufacturer. In addition, manufacturers have been called upon in the field to repair vehicles at their own expense, under the one year or 4000mile warranty generally given to the Army.

General Boatwright, in outlining Army parts procurement policy, told the committee "that the policy with respect to procurement of spare parts for automotive equipment is:

"a. Purchase of all replenishments and concurrent requirements of tires, tubes, batteries, tire chains and electrolite from their respective manufac-

"b. Purchase of replenishment requirements of all standard parts (so called parts common) from standard parts manufacturers.

"c. Purchase of replenishment requirements of certain highly interchangeable parts as well as certain major unit assemblies from unit manufacturers (vehicle manufacturers' sources of original equipment) to the extent practicable under our supply and procurement systems.

"d. Purchase of all other spare parts requirements including all concurrent spare parts requirements, except tires, tubes, batteries, tire chains and electrolite from vehicle manufacturers.'

The General told the committee that reliance upon vehicle manufacturers for spare parts to service vehicles produced by them has been fundamental War Department policy since 1916 up to the present time. However, he pointed out that over the years there has been a gradual lessening of this reliance upon vehicle manufacturers and it is less significant today than at any prior time. From Dec. 31, (Turn to page 68, please)



January 15, 1945

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1943, to April 1, 1944, Army purchases from parts manufacturers were about \$4,000,000. For the seven months, April to October, this amount had increased to \$69,000,000, about 59 per cent in dollar volume of replacement parts. The Army estimates that of the 41 per cent purchased from vehicle manufacturers approximately one-half were parts peculiar to such manufacturers.

In December, 1941, when the war vehicle production program was initiated, according to General Boatwright, it required the production of an astronomical number of vehicles, with full sets of concurrent parts suffi-

cient for one year of maintenance in the field. Because of this situation Army Ordnance departed from established policy in June, 1942, and small suppliers, unit manufacturers, and other sources were utilized.

While some parts were obtained to ease the critical situation, the General said, the following were some of the disappointing results which occurred:

1. Many of the new sources were unaccustomed to doing business under Government regulations.

2. During this emergency period parts had to be accepted with little or no inspection with the result that frequently they were placed in the supply system under new and strange par numbers or, in some instances, without numbers and proper identification.

3. Some unit parts manufacturer did not have a large enough order for a mill run of steel and found that the desired amount and quality of steel could not be located in warehous stocks after acceptance of contracts,

4. Failures of quality and unsatisfactory packaging.

Shortly after the Ordnance Department took over the responsibility a motor transport procurement and supply this temporary arrangement was discontinued.

General Boatwright maintained the Army Ordnance places strong reliand upon vehicle manufacturers for span parts for the following reasons:

1. Warranty and services given by the large manufacturers.

2. Inspection systems which are provided that could not be duplicated by the Government under present conditions.

3. Vehicle manufacturers have proved time and again that they can furnish urgently needed parts orden when the parts manufacturers them selves have been unwilling to contract for such deliveries.

4. Experience has shown that the export packaging of parts can be accomplished by relatively few manufacturers, so any appreciable extension of direct buying would cause a shuffling of boxing facilities and require the establishment of additional packaging plants, even though all parts are now being boxed with facilities in existence

5. Direct procurement from spare parts manufacturers requires the assumption by the Ordnance Department of numerous services and responsibilities which the vehicle manufacturers perform to a great extent at present.

6. Every Government contract currently executed presents the possibility of another termination. The Army has based its plans for a speedy reconversion upon negotiated lump settlements with prime contractors, who will in turn assume the tremendous task of quickly settling a multitude of subcontractors claims. To the extent that more parts manufacturers are made prime contractors instead of subcontractors, the termination job will be complicated and the administrative burden will be magnified, as will be the need for additional personnel.

In closing his case for Army Ordnance purchases of spare parts from vehicle manufacturers rather than spare parts manufacturers, General Boatwright said:

"It is true that parts bought from vehicle manufacturers might be bought for less from parts manufacturers, but such additional costs represent payment for spare parts services rendered. Such lesser prices do not take into account the value of the services obtained under buying methods actually followed, not the cost of tremendously increased Government overhead that has been averted.

(Turn to page 70, please)





MYSTERY MEETS ITS MASTER

Laborious, time-consuming calculations slowed the progress of science and industry until Sir John Napier found the key to the mystery. In like manner, complex, time-consuming manual operations handicapped many large scale production schedules until Clearing Presses made new techniques possible.

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The engineer's slide rule is a direct descendant of Napier's logarithms. Modern low cost production of large units from bath tubs to sedan bodies is descended from a new conception of the purpose and possibilities of the press as a tool, and that new conception was Clearing's.

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1. No leakage drain lines are required. 2. All working parts are contained in the nozzle tip assembly.

3. The nozzle tip assembly fits in other makes of nozzle holders. 4. The standard nozzle tip assembly runs a wide range of types and sizes of engines—20 to 300 horsepower, and six different types of combustion chambers. 5. The nozzle holder assembly contains no working parts and serves only as an adapter to hold the nozzle tip assembly in the cylinder head and conduct fuel from the tube to the nozzle tip assembly. 6. There is no long lapped fit on the nozzle valve, which eliminates possibility of valve stickage. 7. All parts of the nozzle valve are inside the tip body between injections, protected from combustion chamber heat and carbon. 8. The nozzle tip assembly is sealed to prevent unauthorized changing of factory settings. 9. A filter is provided to protect the nozzle tip assembly from dirt during shipping, handling, and running. 10. The nozzle tip assembly is suitable for gasoline injection, as well as fuel oil. 11. The light weight of the working parts in the nozzle tip assembly makes the tip particularly well suited for high speed engines. 12. The small size of the working parts in the nozzle tip assembly makes possible the manufacture of special small size nozzles for aircraft engines and other applications where small size and light weight are desirable. 13. Clamp-type and screw-type holders are available to meet the tequirements of all engines. 14. No special tools are required to disassemble the nozzle holder assembly. 15. No adjustments are required when a new nozzle tip assembly is installed in the field, because all of the necessary settings are made at the factory before the tip assembly is sealed.



"Undoubtedly out of the 300,000 to 500,000 parts items that have been procured in the war period it would no be difficult to show cases in which prices were in fact paid for the particular item out of all proportion to the services rendered in the procurement and handling by the vehicle manufacturers On the other hand, there are many cases to be found where such parts have been delivered by the vehicle manufacturer at a loss. Studies made on this subject indicate, however, that taken by and large, less net profits accrue to the vehicle manufacturer on their wartime orders than on similar peace business.

"The system in use under present policies is believed to be the most economical and efficient that can be followed; it most certainly is the only system that would have accomplished the Ordnance Department's mission."

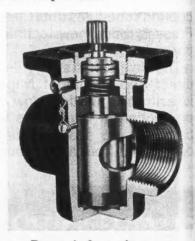
New Products for Aircraft

(Continued from page 62)

Connected to the master control switch in the cockpit, new control system is automatically turned on when the pilot starts the engines. However, unless heat is required immediately, the heating system remains inoperative until outside temperatures fall to a point requiring the addition of heat for passenger comfort. At this point, without any attention from the pilot at all, the heating system starts delivering heat to the cabin in the exact amounts needed to maintain the preselected temperature—usually 70 deg.

Non-Pulsating Fuel Transfer Pump

A non-pulsating fuel transfer pump for use on heavy aircraft has been brought out by the Romec Pump Co., Elyria, Ohio. This pump, designated RD-5530, has a rated capacty of 900 gph at 27.5 volts, 14-in. Hg discharge pressure, 8-in. Hg inlet suction, 14.5 amp. maximum. Ports are tapped 14. in. N.P.T. It is non-corrosive throughout and is said to be unaffected by extreme temperatures.



Romec fuel transfer pump

Precision plus Production

Extreme accuracy, high production and convenience of setup and operation make this new Norton grinder ideally suited for grinding a vast assortment of small revolving parts that are used in instruments and the mechanisms of modern high speed machinery and appliances. Catalogs and information on this new Norton 4" Type C Grinder on request.

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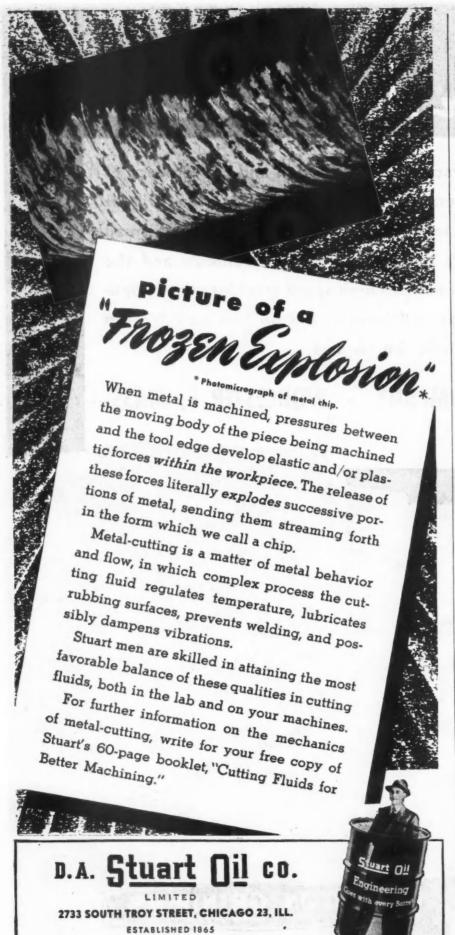
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Warehouses in Principal Metal-Working Centers

De-Icing System

(Continued from page 25)

specified curvature. Weighing 6 ounces per foot run, each unit consists of a square section metal tube (Fig. 2) divided into two compartments by a central web, B; one compartment forming the primary feed channel, A, in which the fluid passes along the whole length of the unit. Small flow-control tubes convey the liquid to the other compartment, which contains the porous metal E with one side of it exposed.

De-icing fluid is discharged by the pump through the inlet pipe I to the primary channel A and thence through the control tubes C to the secondary channel D; from the latter it passes through the porous metal spreader E on to the wing or other component in the leading edge of which the spreader is installed. The secondary channel D is divided at regular intervals by liquid-tight partitions or dams G, with a control tube leading into each section, which ensures a near approach to uniform pressure to and through all parts of the porous spreader. Fixing screw bushes H are provided at a suitable number of points. The porous spreader is made from metal powder of known grain size. It is sintered in position in the tube, thereby becoming, in effect, integral with the tube. Other parts are brazed to the main tube.

The multi-outlet pump, Fig. 3, is driven by an integral electric motor, usually 24 volts, through reduction gears, giving a camshaft speed of half motor speed. The pump is of cellular construction, each cell, Fig. 4, housing two complete pump, units. Normally there are from 4 to 10 units, each with its independent discharge outlet. Each unit is designed to deliver up to 21.6 pints per hour at a maximum pressure of 225 psi. By a screw adjustment the quantity delivered by any unit can be varied from zero to maximum. Provision is made for the adjustment to be locked and

Pumps are of the plunger type, operated from a camshaft by rocker arms, the fulcra of which are carried by spring-loaded anchorages. In the event of the delivery pressure of any unit exceeding 260 psi. the fulcrum anchorage is deflected and absorbs rocker movement. The pump body, comprising cells and end plates, is completely flooded with de-icing fluid, which alone is used for lubrication of the pump and

the reduction gearing.

Rated for continuous operation at 0.18 hp at 4000 rpm, the integral motor is a four-pole machine with a current consumption of 8.7 amps at 24-29 volts. Consumption during normal running at day temperatures is 5-6 amps. Aircooling is effected by a centrifugal fan built into the machine and drawing air through the carcase.

The controller has three switches and two indicator lights, green and

(Turn to page 76, please)



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WHAT is the future of your product after peace comes? How keen will your competition be, and what can you do to prepare against it? Because we have been privileged to assist in the improvement of many war machines by means of forgings, we have gained a fund of information you will find worth sharing.

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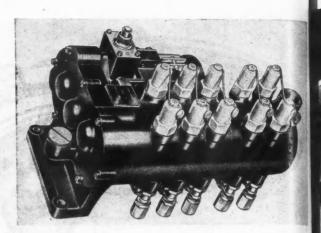
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red. The upper switch, marked "Automatic," puts the ice detector into circuit; the controller will then be brought into operation automatically if and when ice forms on the detector. The second switch, marked "Manual," brings the controller into operation independently of automatic ice detection. With the controller operating on either of these switches, the top (green) light glows whenever the pump is working.

The third, "Emergency," switch can be operated only by breaking a seal. This switch by-passes the relays of the controller, causing the pump to operate continuously. The red light then glows. The continuous period of run-

Fig. 3 — Ten unit TKS pump with integral driving motor.



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Brake Lining
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Grizzly is a respected name, whether in the forests or the brake lining industry! Like the grizzly bear, Grizzly Brake Lining owes its reputation to stamina, ruggedness and great tenacity. In over 28 years, millions of vehicle owners have learned to rely on Grizzly's qualities for better, safer stopping. Do you know Grizzly? Automotive and Aviation designers,

engineers and executives are reading the book "Building UP to a Name". Send for your free copy. Grizzly Manufacturing Company, Paulding, Ohio.

"Bear in Mind"



ning which also occurs, as previously mentioned, when first the controller is brought into operation by either the automatic or the manual switch, is usually one minute in duration and is followed by a 20 per cent on-off ratio of intermittent running. Provision for emergency operation is made because of the present incomplete knowledge of the conditions that give rise to the most serious kind of ice formation; it gives a five-fold increase in the rate of pump delivery.

The de-icing fluid used with the TKS system has a specific gravity of 1.075 at 60 F. To produce an active film with low rates of flow it was found necessary to use a viscous fluid capable of producing a relatively thick and tenacious coating. The viscosity curve of the TKS fluid shows that the necessary viscosity (100-200 Redwood seconds) is obtained at the normal working temperatures of 32 F to 14 F, and that at the limiting temperature (—40 F) it is 2400 Redwood seconds, which is within the maximum permissible range of the system.

(Turn to page 80, please)

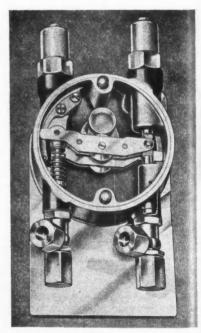


Fig. 4—One cell, containing two pump units, of the TKS multi-outlet pump.



way in reducing weight, boosting output and increasing service life on every job undertaken. Engineering like this has helped keep America's air fleet first in the war . . . it will be equally

effective in holding that place in peace.

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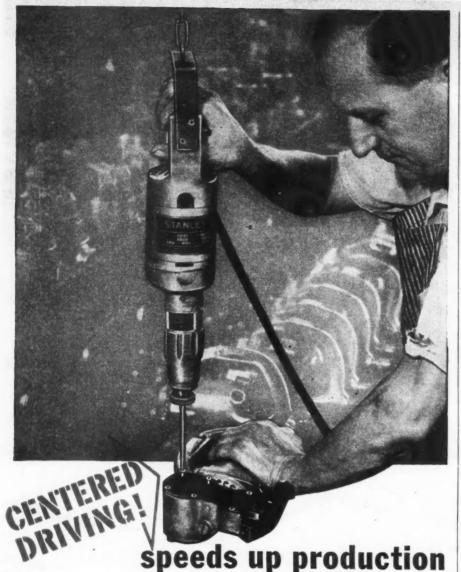
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In capacity, the de-icing liquid tanks vary from 10 to 30 Imp. gallons. The tank capacity required is, naturally, dependent upon the area of the airfoil surfaces to be served; in other words, the size of the aircraft. Generally, sufficient fluid is carried to serve for 5½ hours at normal intermittent delivery or 1½ hours continuous delivery. On this matter of tank capacity, the following comments are given by the manufacturers of the TKS system:

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"The necessary de-icer duration depends on the rate of climb and the ceiling of the modern aircraft rather than upon its maximum duration, and it is clear that only in the case of very short range aircraft, or aircraft having a low ceiling, need the de-icer duration equal the duration of the aircraft. The worst set of conditions it is reasonable to allow for, in the case of a bomber or transport aircraft having a full load ceiling of 20,000 ft or more, is that, in any one flight, the following operations under conditions icing should be allowed for:

"1. Climb to safe altitude at full load.

"2. Descent to target at 300 ft per minute.

"3. Climb to safe altitude at moderate load.

"4. Descent to base at 300 ft per minute.

"The de-icer endurance, therefore, should be the sum of these times (assuming that the safe altitude is 20,000 ft) plus 50 per cent for emergencies."

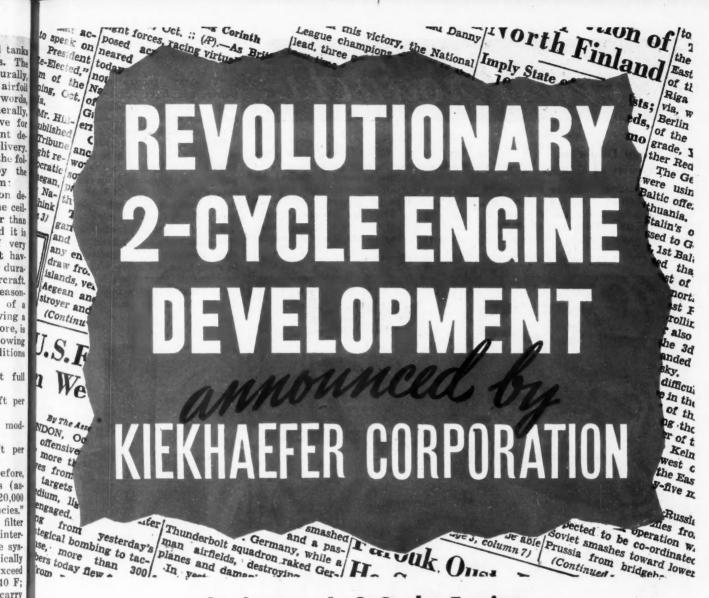
An efficient and easy-to-clean filter is provided to prevent dirt from interfering with the functioning of the system. Pump pressure is automatically relieved should back pressures exceed twice the working pressure at —40 F; the porous metal distribution will carry twice this relieving pressure without distortion.

Approximately 50 per cent of the weight of the system is due to the fluid that must be carried. Installations carried out on a number of different aircraft have a total weight, including fluid, of less than 0.6 per cent, on the average, of the all-up weight of the machine. All components, including the distributors, are readily removable for inspection or replacement without disturbing the aircraft structure.

United Motors Now A Division of G.M.

United Motors Service, formerly operated as a wholly-owned subsidiary of General Motors, on December 31st became a division of the Corporation and thus began a new chapter in its 28-year history.

W. N. Potter, general manager of the division, said that United Motors status as a division would in no way affect the contractual relationships with United Motors Service authorized accounts. Neither will the change affect personnel in the division, Mr. Potter and his associates retaining their former responsibilities.



At Last... A 2-Cycle Engine That Operates with Improved Efficiency on Leaded Gasoline and Detergent Oils

Now it can be told.

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The outstanding superiority of 2-cycle engines in delivering greater horsepower per pound of weight and their greater dependability due to the absence of high mortality parts used in the other type engines have caused them to be demanded in tremendous quantities by the Armed Forces.

It no longer is a secret that the conventional small engines developed immediate serious mechanical as well as ignition trouble when leaded gasoline and detergent oils were used. This gave more impetus to the 2-cycle design principle, and industry was called upon to provide engines that would meet the requirement.

Kiekhaefer engineers accepted the challenge and met it. It can now be revealed that new, proved, exclusive design features allow Mercury 2-cycle, air-cooled engines to operate

with improved life and efficiency for thousands of hours without service requirement on a mixture of leaded gasoline and detergent oils.

Mercury engine's exclusive design permits the use of ordinary commercial spark plugs, and they will give satisfactory performance through periods more than ten times as long as was formerly possible between spark plug changes. General service inspection frequencies can now be spaced at intervals more than twenty times greater than previously accepted standard.

The fact that these engines are rolling off the production line has established a performance standard that changes the entire scope of 2-cycle engine applications.

As conditions permit, Kiekhaefer will welcome the opportunity of working with you on your engine problems.

R

Builders of Gasoline Engines Exclusively

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MERCURY OUTBOARD MOTORS ... Built to Use ... Built to Last

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New Products

New Pump Dispenses Wide Variety of Materials

The Industrial Alemite Division of Stewart-Warner Corp., Chicago, Ill., has placed on the market the Alemite "Versatal" material pump which, until recently, was a rigidly controlled item used by the Navy for applying antifouling paint on ship bottoms.

These pumps present a radical departure in many aspects, from the conventional type of "pressure pot" spray apparatus. They are designed to dispense and apply a wide variety of materials, including paints, lacquer, mastic,

sealers, insulating materials, fibre a cement coatings, caulking compound etc.

etc.

"Versatal" pumps operate on a power, and from one to six operate may work simultaneously using many different spray heads and may rial lines from a single pump.

The material is delivered from a pump at pressures 4½ to 5½ times a pressure introduced to the "Versata pump. It supplies material through several hundred feet of hose, thus making it possible to reach places here fore difficult for spraying operations.

These pumps eliminate the necessing of maintaining an air head in the material container. This makes it possible to reload the container while operation continue uninterrupted.

"Versatal" pumps are now available in several types and sizes. Mode



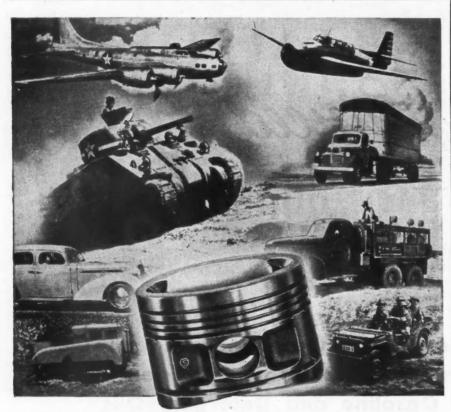
Alemite "Versatal" material pump

7804-C, stationary barrel pump, is designed to fit over the top of any standard 54-gallon barrel and is built especially for the handling of heavy of viscous materials. Model 7805-C, also a stationary barrel pump, is specially designed to handle fluid type materials. There are also portable "Versatal pump models which come complete with an attached 12-gallon material container.

Universal Bench Optical Comparator

The Jones & Lamson Machine Ca. Springfield, Vt., has developed a 14-in universal bench optical comparator and measuring machine which has a table 16 in. long, and allows measurements of lead and spacing up to two in. In be made. A handwheel graduated in .0001 in. operates on a hardened and ground thread spindle for making vertical measurements up to 134 in. A ball thrust bearing with hardened plates in incorporated in the handwheel to eliminate friction and to assure ease of operation.

(Turn to page 84, please)

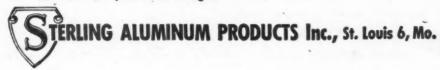


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artime service and modern fuels call for Hard-Surfaced Valves to withstand intense heat ... resist abrasive wear ... prevent oxidization d to remain hard . . . assuring continuous performance. Hard-Surfaced Valves are now included in the postwar plans of many leading engine manufacturers . . . We will promptly quote on your requirements, or if you wish, a Scully RAILROAD representative will call on you.

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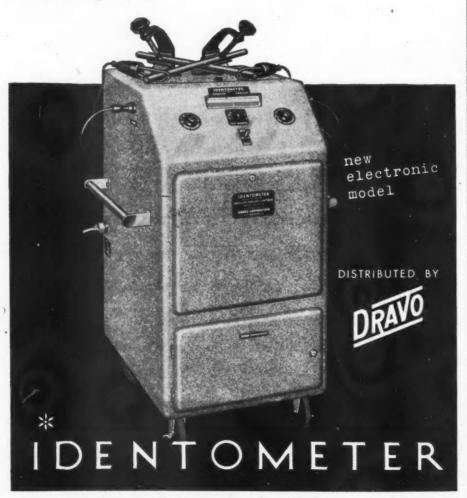
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On freight cars, in warehouse stock piles, in the processing department—at any accessible spot where proper current is available the Identometer can be set up for rapid, positive tests to check material against specifications by comparing heats.

Attach a known sample to this handy, portable instrument and the operator can test any number of pieces to check the quality for accurate control.

An operator, with only a few hours training, can use Identometer to test most rolled or forged ferrous material and provide a safeguard against error. Read the whole story of this new metallurgical tool!—What it is and how it works is told in Bulletin ID. Address—Dravo Corporation, National Department, 300 Penn Avenue, Pittsburgh 22, Pa.



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BY THE USE OF REFERENCE SPECIMENS



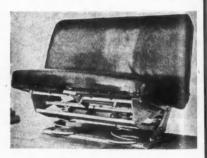
Jones & Lamson comparator

On one end of the table is a verning segment with provision for compounding the table 15 deg. either side of center, for projecting hobs, worms and threads normal to their helix angle. As angle measuring attachment is provided for measuring angles in degrees and minutes.

Spring Suspended Seat For Motor Vehicles

Stemming from successful application on military tanks, a unique spring suspended seat design is offered to the industry by the Monroe Auto Equipment Co., Monroe, Mich., for use of tractors, trucks, buses, passenger can, and industrial equipment. About 200,000 seats of the military type are said to be in service to date.

While the same design principle is employed for all applications, certain variations have been adopted for specific uses. For example, the truck seat—offered in two types, a single-seat and a double-seat model—employs a variable rate spring for the suspension



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Monroe spring-suspended seat

in combination with a double-acting hydraulic shock-absorber. In addition, a long auxiliary spring is provided to limit the free height of the seat. This arrangement is found on the single seat model. For double-seat models, the unit embodies two variable rate springs, a single shock-absorber and an auxiliary spring.

Seats for passenger cars and buses are quite similar to the double-seat truck model, while the seats for industrial equipment are more comparable to the single-seat truck model.

(Turn to page 86, please)

OF CARS TO COME...

A factor to be reckoned with

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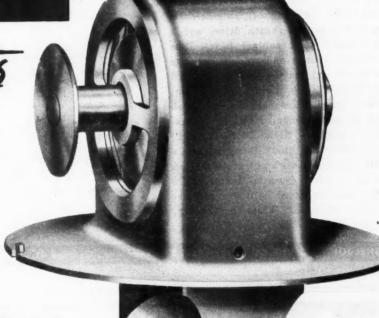
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Thermostals

Motor temperature control was long ago recognized as a performance factor—and Dole Thermostats were designed for cooling systems at almost the same time.

New cars will have the same problem—
possibly modified. There will be Dole
Thermostats, also modified as needed, to
assure quick warm-up—reduction of
crankcase dilution—savings of gasoline,
oil, and the motor.



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1" Collet Capacity 111/4" Swing

The SHELDON 10" x 1" series Precision Lathes combine the advanced features of extra collet capacity (1-inch). extra swing (111/4 inches), an efficient 4 speed. V-belt underneath drive, and a commodious steel cabinet base. The headstock, spindle and spindle bearings are larger and heavier than is standard for 10-inch lathes giving not only increased production capacity but also assuring permanency of this lathe's extreme accuracy. SHELDON 10" x 1" Lathes have full quick change gears, a worm feed apron with power cross feed and every other essential feature of a quality machine tool, still are surprisingly low in price. Write for Catalog.

Full Double Wall Apron. Spline Drive. Double Half Nuts for thread cutting. Smoothly operating effi-



cient clutch — just a slight turn of wrist between full release and positive drive. Standard industrial sized controls. The tractor seat utilizes a variable rate spring under the pan in combination with a rear-mounted hydraulic double-acting shock absorber. In addition, the suspension includes a stabilizer bar, pivoted from the chassis to protect against side sway.

It is of interest to note that the variable rate spring used in all of the above arrangements is so proportioned as to provide a good ride under all conditions.

Protective Coating for Spray Booth Sidewalls

Triad PR, a new protective coating for the sidewalls of both wet and dry spray booths, has been brought out by Detrex Corporation, Detroit, Mich. With this new coating between the walls and the layer of overspray that normally builds up, quick and easy cleanup is obtained. The booth so protected is stripped clean simply by spraying with water or steam—the Triad PR and accumulated paint flum off together. In dry booths which have no drainage facilities, the protective coating greatly facilitates scraping of the paint. Triad PR can be applied by either brush or spray gun.

New Plating Process

A new plating process using three common metals—copper, tin and zincis providing a tough, non-magnetic coating for the delicate parts of a host of
instruments that check the performance
of fighting machine, the Westinghouse
Meter Division at Newark, N. J., disclosed recently. The new process has
been made available to all American
industry through the Hanson Van
Winkle-Munning Company, of Matawan, N. J., who have been licensed by
Westinghouse for the commercial manufacture of ingredients and processing
equipment.

For instruments destined for tropical climates, this new plating process has particularly proved its value because in the high humidity of those regions corrosion is more difficult to combat than in the drier atmosphere of

the temperate zones.

A standard test for combat instru-(Turn to page 88, please)

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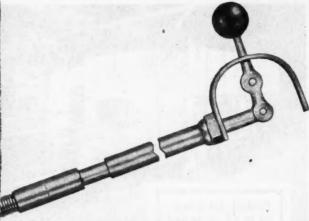
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For Hardening Small Parts 175 to 2000 lbs. per hour Uniformly — Scale - Free — Continuously

The above gas fired radiant tube chain belt furnace is one of three we installed in one plant. h Hundreds are in operation handling products such as listed at left. We build them for gas, oil or electrically heated.

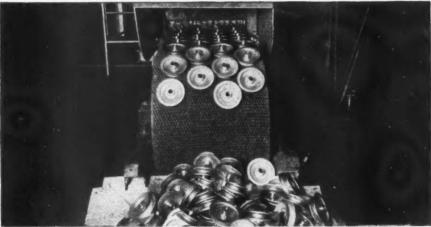
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The EF chain best conveyor type furnace is one of the most satisfactory general purpose furnaces built for the continuous, uniform, economical production heat treatment of small and medium size products. We will be glad to send complete data on these and other types we build.

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Products difficult or expensive to make in one piece can be made in several pieces and joined. Products requiring several stampings joined or requiring screw machine parts, forgings and stampings to complete the unit, can be neatly and economically joined right in your production line.

Strong, leak-proof joints are made and the completed unit is discharged from the furnace-clean and bright. Any number of joints in the same product or any number of pieces can be joined at one time.

Investigate This Process for Joining Your Aluminum, Brass, Copper or Steel Parts.

Send for printed matter showing various types of EF brazing furnaces.

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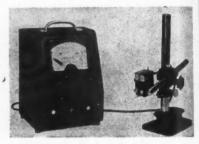
Gas Fired, Oil Fired and Electric Furnaces --- For Any Process, Product or Production

ment parts plated by the new process is to subject them to 200 hours of con tinuous salt spray-and the parts mus come through with no signs of come sion, nor even any accretion of salt particles.

The process also permits use of ven much thinner coatings than do conven tional anti-corrosives. To protect in strument parts with nickel plate, for example, at least five ten-thousandth of an inch of metal is needed-two and a half times the 2/10,000th-inch thick ness needed when bright alloy coating is used. This reduction in plate thick ness improves the electrical conductivity of current-carrying instrument parts by allowing current to flow all through the outer layer with greater efficiency,

Reversing Feature For Height Gage

Pratt & Whitney have announced a new feature which has been added to the P&W Electrolimit height gage. The original head measured in one direction only. The new head carries a small lever which permits setting the gage for measuring either up or down, a big



P&W Electrolimit height gage

advantage in many tool-room setups The gage may be furnished complete with indicator and either of two stands, or the head alone may be purchased separately. This permits owners of the previous model to substitute the new head without replacing the stand or indicator.

The new Reversing height gage operates on the same basic principle as all P&W Electrolimit Gages-the translation of a mechanical movement into electrical magnification. Mechanical parts are made by Pratt & Whitney, and all coils and electrical parts are made by General Electric.

Standard Surface-Roughness Specimens

A set of standard surface-roughness specimens, each representing one clearly identified degree of surface roughness ranging from the smoothness of a bearing surface to the roughness of a flame cut, has been introduced by the Special Products Division of the General Electric Company. The new specimens are designed to permit the engineer or draftsman to select and specify by symbol the especial degree of sur-

(Turn to page 90, please)



as versatile as manual control . . . and interchangeable with manual control

The Bullard "MAN-AU-TROL" principle of automaticity—as applied to a new Vertical Turret Lathe, for example—makes a manually-operated machine 100% automatic without taking away any of its multi-purpose powers... not even its manual operation.

You know the wide range of work a manually-operated machine can handle. With the Bullard "MAN-AU-TROL" applied to it, you can produce the same range of work . . . faster . . . with a degree of repetitive accuracy such as only the elimination of human or cumulative error can effect.

Yet you can shift from automatic to manual opera-

tion by moving a single lever...you can change over the automatic control to produce a different piece in hours, not days.

Such revolutionary transformation from manual to automatic operation is possible because the Bullard "MAN-AU-TROL" gathers at one "nerve center" all the mental and muscular impulses of the manual operator... without interfering with the machine's muscles. It represents your best opportunity to lower costs through increased production — without sacrificing the option of easily accommodating new specifications.

The Bullard Company, Bridgeport 2, Connecticut.

The automatic control that is as versatile as manual control



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Metal Stampings, Assemblies, Tools and Dies Medium size stamping plant—100 employees—requires services of experienced man.

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Give complete details, age, experience, etc.

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Mr. David Saxon

Be 100% With 10% Buy War **Bonds** face roughness allowed for a particular machine part. They are also desirable for use in the shop to enable the mechanic to determine the exact swrface roughness allowed by drawings.

The set consists of ten metal specimens each approximately 2 in. by 24 in. by 1/8 in. in size. Several of the specimens are divided into two and in some cases four surfaces, all of which while equally rough, are produced by different machining methods. In all, the ten specimens simulate 25 surfaces, each surface representing the roughest one acceptable for that particular symbol regardless of the method of producing the finish or the material of which the part under inspection is made. The specimens are furnished in a 12-in. by 6-in. by 11/4-in. cloth-lined wooden case.

Complete Set of Gage Blocks

To overcome the dimensional limitations of smaller sets of gage blocks, Continental Machines, Inc., Minneapolis, Minn., has produced DoALL gage set No. 118-Master Series. This 118piece set is available in three grades of accuracy: .000002 in. for laboratory use; .000004 in. for general inspection, and .000008 in., the working set. These



DoALL gage set No. 118-Master

gage blocks have a hardness of Rockwell C-65 and are produced from carefully selected alloy tool steels free from imperfections. There is a minimum of corner radius which is uniform on all sizes of DoALL gages so as to provide the largest possible measuring surface.

Every gage is etched with its individual size clearly and legibly marked. In addition to the size marking, each gage is individually etched with its own serial number so that it can always be identified from similar size gages of other sets.

Combination Crane Truck

The model L-11C combination crane truck announced by The Elwell Parker Electric Company, Cleveland, Ohio, has a separate motor for raising and lowering the boom. In previous models a single motor served to raise and lower both boom and hook, by means of a ratchet boom adjustment which was actuated when the lift hook was pulled

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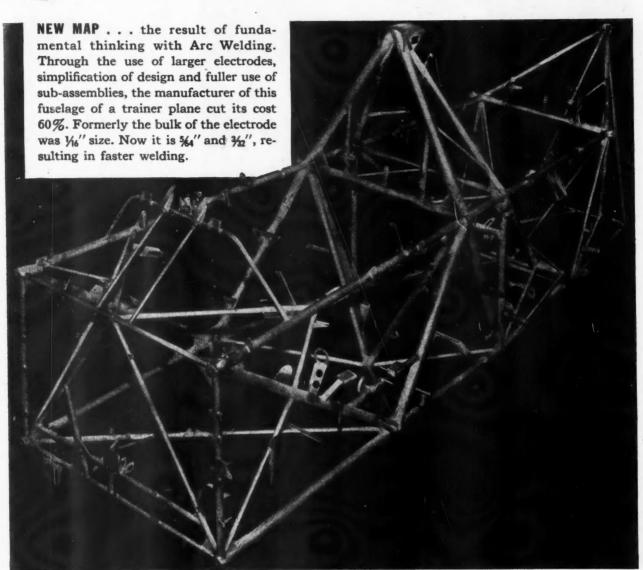
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"A New Map is Unrolling," he says

LOOK, MARSHAL SMUTS, how fundamental thinking is revising old concepts in the design and production of aircraft structures:



The Lincoln Engineer nearby will gladly help you revise old concepts with Arc Welding.

THE LINCOLN ELECTRIC COMPANY . CLEVELAND 1, OHIO





Consider this example of Western skill that assures you precision parts at quantity production economy

Designers who planned this torque rod ball for heavy-duty trucks demanded extra-rugged strength to take a beating in war service and super-smooth finish to prevent binding or wear on its composition mating piece. So we turned and ground it from a rough forging of SAE 4340 steel, over 5" long, 3" diameter at the ball, better than meeting the specification of 8-12 micro inches profilometer reading on ball surface, a .004 total tolerance on diameter, accurate taper on shank and class three fit on threaded end. Down to precision parts of watch works size, you can depend on Western skill and ingenuity to produce them — with ultra-exactness, speed and economy. Prompt attention to your inquiry — it pays you to write us.

Western Complete Service — Special precision screw machine products to specifications. Capacity range, $\frac{1}{16}$ " to $\frac{45}{8}$ " round. Complete equipment for all types of secondary and processing operations — precision grinding, heat-treating, hardening, pentrating.





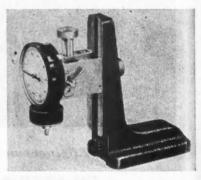
Elwell Parker crane truck

up against the boom. By providing a separate motor for each function the operator is given a greater freedom of choice in manipulating the load.

The combination crane truck is a 4 way truck, serving as a lift-truck, a load carrier, crane and tractor. It loads itself either by picking up skid loads with the lift platform, or by lifting heavy parts and placing them on the platform for transport. tractor it pulls trailer cars, which may be loaded by means of the crane. The crane may be made available for heavy lifting at points where there are no overhead cranes. This model has a capacity of 6000 lb on the platform, 2000 lb on the hook at 42-in. radius and 1000 lb on the hook at 84-in. radius. It will travel at 6 mph with no load and 5 mph with full load under normal conditions.

Pedestal Indicator for Use in Magnetic Field

The Bartelt Engineering Co., Beloit, Wis., is making a non-ferrous pedestal indicator for free use in an active magnetic field. All parts of this Model "DNF-10," except the dial indicator, are



Model DNF-10 pedestal indicator

constructed of hard brass. This makes it suitable for such service as setting up and checking work which is being held on a magnetic chuck, an operation that is impossible with an ordinary height gage or other measuring device because of the strong pull of the magnetic field.

The dial of the "DNF-10" has a first division reading of .0001 in. Overall height is 8 in. with a range of approximately 4 in. from the base surface upward.

(Turn to page 96, please)



The first step in making Ledaloyl bearings is to reduce Pre-Cast Bearing Bronze to fine powder.

Powder Metallurgy



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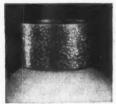
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80,000 pounds per square inch are required to compress LEDALOYL powder into an average size bearing.



Place a LEDALOYL bearing on a lighted lamp bulb. Watch the oil sweat from the pores. Remove the bearing and the oil is reabsorbed. This illustrates the self lubricating and oil retaining action.

for the Products of Tomorrow

Manufacturers planning their postwar products will do well to consider the use of powder metallurgy. It offers many distinct advantages in the way of low cost, light weight, long and dependable service.

Sleeve bearings are a good example. When manufactured from Johnson LEDALOYL, they combine all the good characteristics found in other bearings... plus self lubrication. This often enables the designer to eliminate lubrication devices and to seal the bearing in place. When properly designed and installed LEDALOYL outlasts the motive unit in which it is used.

It's an easy matter to determine how LEDALOYL can serve you. Simply call in a Johnson Engineer. Permit him to review your applications . . . to make recommendations based on facts . . . free from prejudice. There is one located as near as your phone. Why not call him—TODAY?

JOHNSON BRONZE CO.
625 S. MILL STREET NEW CASTLE, PA.



Founded in 1920

DETRIX LEADERS IN METAL CLEANING 15 Years

TWENTY-FIFTH ANNIVERSARY 1945

A quarter-century of leadership in the metal-cleaning field may well be reason to "point with pride". At Detrex, however, past achievements stand only as a challenge—an incentive toward providing consistently better products for the future.

Thousands of metal working and finishing plants throughout the United States and Canada know from their own records that Detrex machines and chemicals are unexcelled in performance. Yet Detrex research continues as ever, bringing constant improvements in products and processes—improvements based on 25 years in the engineering chemistry of soil removal—improvements which assure the ultimate in cleaning at lowest unit cost.

For the latest developments in metal-cleaning and allied processes, consult the nearest Detrex office.

In our 25th Anniversary Year, Detrex products include the following: Degreasing Machines using Detrex Stabilized Safety Solvents . . . Metal Parts Washers for Alkali, Spirits and Emulsion Cleaning . . Specialized Metal Cleaning Chemicals—Perm-A-Clor and Triad Degreasing Solvents . . Triad Alkali and Emulsion Cleaners . . Triad Paint Stripping and Spray Booth Compounds . . . Rust Proofing and Processing Machines . . . Oil Extraction Plants . . . Drycleaning Equipment

Bulletins describing all of these products are available on request.





DETREX CORPORATION

13001 HILLVIEW AVE., DETROIT 27, MICHIGAN

Branch Offices in Principal Cities in U. S. A.

Acid-Proof Apron

A heavy duty acid-proof apron, mad with a treated fabric combined with a new plastic by a special calendering process which impregnates the fabra so the product is acid proof through out has been placed on the market by the B. F. Goodrich Company, Akron Ohio.

The apron is made in one size only 35 in. by 47 in., full. It weighs 1% complete with %-in. wide tape, criss cross shoulder design, attached with reinforced grommets at top and side, and with edges hemmed throughout. It can be washed or cleaned without harm to its acid-proof qualities.

Ford Tri-Alloy Bearing

(Continued from page 21)

edges, burring operations are done, and they are ready for inspection and ship ment to three outside firms for forming and machining.

A careful 24-hour laboratory check is kept on bonding and on analysis of the mix. A check is made on the alloy on each eight-hour shift, and a bond test is made each half-hour on each production unit. Bonding is tested by hammering the strip double and inspecting for adhesion. The company has a battery of ten complete units, with six operating at present and the rest scheduled to go into operation soon.

Percentage of scrap has been greatly reduced since the bearing job was The overall rate currently started. stands at five to seven per cent scrap due to material defects. The scrap rate has been reduced approximately one-third in the past two months on machining operations and Ford is certain of reducing the overall rate to well below five per cent. On a comparative cost basis, tri-alloy bearings are more expensive than the cadmium type, but the company hopes to narrow the differential to the point where the difference in cost will not be prejudicial to their use in postwar automobiles. Although most of the production of trialloy bearings so far has been for use in military vehicles and trucks, Ford dealers have received a limited number and will get more as output goes up. It is estimated that approximately 1% million of the new bearings will be turned out in 1944, with production currently, hitting around ½ million per month.

Another sideline development on bearings at Ford deals with the corrosion of bearings under conditions of acidity in the crankcase. When a certain bus fleet encountered considerable trouble with corrosion, Ford technicians applied a thin coating of lead and indium to the tri-alloy bearings. No reports on the results of this development are available as yet, however.

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RIES



Would you buy a new car with a discolored windshield?



Would you buy war stockings if you could get nylons?



Would you buy a distorting mirror?

Clear as spring water—you can see right through to the core—that's "FILMONIZE" Transparent TAPE!

We welcome comparisons. Take a yard or a roll of "FILMONIZE" Transparent TAPE, place it beside the TAPE you now use and you'll see the difference. "FILMONIZE" SELF-SEALING TAPE speaks for itself.

Call your local distributor for a demonstration today. He can deliver "FILMONIZE" SELF-SEALING TAPE in quantity for all industrial or commercial uses.

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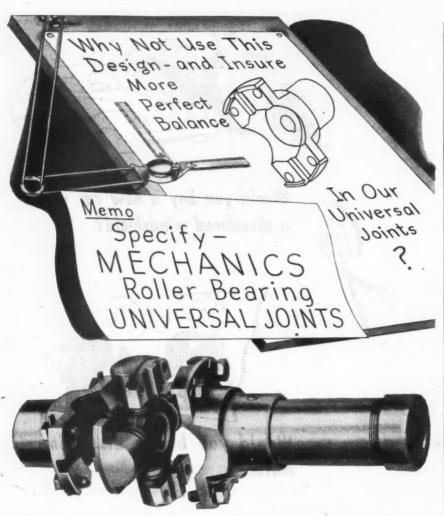
- Easy to use ... strips easily from roll.
- No "curl-back"..no tangle..no waste.
- Seals without water.
- Widths from ½" to 18" throughout the "FILMONIZE" line.





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MORRISTOWN, NEW JERSEY



The parts of MECHANICS Roller Bearing UNIVERSAL JOINTS that have appreciable effect on smooth running balance are machined Forging irregularities which might cause an out-of-balance condition are removed. Let our engineers show you how this operationsmoothing feature, and several other MECHANICS advantages, will benefit your new and improved models.



MECHANICS UNIVERSAL JOINT DIVISION

Borg-Warner Corporation

2020 Harrison Avenue, Rockford, III. Detroit Office, 7-234 G. M. Bldg.

Adhesives and Sealants

(Continued from page 19)

evenly with a thin brush or spray coat of cement and the solvent allowed to evaporate, to the point where the cement is tacky to the touch, before the two surfaces are pressed together. It is almost axiomatic that the ultimate bond strength of any cement dispersed in a suitable solvent depends on the amount of solvent that is evaporated.

4. The bond should be effected under a firm, even pressure by means of a

metal roller or equivalent.

5. Cemented assemblies should be allowed to air cure at least twenty-four hours before installation. The curing time may be lessened by the discriminate use of heat (150 F approximately), provided suitable equipment is available.

Plastic Cements

There are various types of plastic cements used in airframe construction, and here again the nature of the materials to be bonded must influence the choice of an adhesive. The following brief description covers several of the more common types used in conjunction

with the parent materials.

1. The cellulose ester forms the basic constituent of the cellulose adhesives. Cellulose nitrate is the more commonly used base, but the acetate is equally satisfactory for certain applications. The mixed esters; such as, cellulose acetate butyrate and propionate, are sometimes used in preference to the straight acetate, due to their better adhesive qualities. These cements are usually composed of the cellulose ester with a resin, solvent and plasticizer added to modify them as required. Cellulose nitrate is soluble in ethyl and butyl acetate, and cellulose acetate is soluble in acetone and methyl and ethyl acetate. The mixed esters are soluble in numerous compounds; such as, acetone, methyl ethyl ketone, butyl acetate and ethylene dichloride. The cellulose adhesives manufactured by duPont are excellent examples.

2. The cellulose ether group of ce-, namely, ethyl, benzyl and (Turn to page 100, please)



AIRCRAFT Anti-Vibration LIT Locked Cap Assembly-Vibration-Resisting



Cap Assembly—Vibration-Resisting Elements—Anti-Contraction—Expan-sion. Fuses for all instruments, high, low voltage, inst., aircraft, communications, engine circuits, radio, automobile, auto radio, clips, mountings, panels. Send for Catalog.

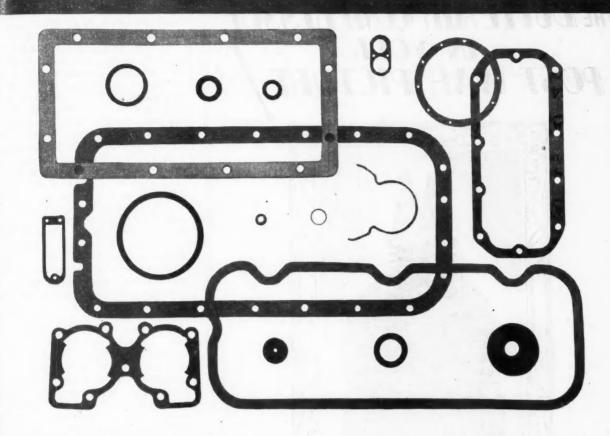


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DESPITE wartime difficulties, Armstrong can continue to supply your needs for gaskets, packings, and seals. And, since these products and our equipment for making them are the same for your war or peacetime requirements, we face no reconversion problems.

The Armstrong Line offers you many different cork compositions, synthetic rubber compounds, cork-andsynthetic-rubber compositions, and cork-and-naturalrubber compositions. It includes also No. 841 Fibrated Leather and other fiber sheet packings, rag felt papers, and natural cork.

This wide range of materials, coupled with Armstrong's 33 years' experience in the field, assures you of unbiased recommendations when you consult us about your sealing problems.

For details about Armstrong's sealing materials, write for your free copy of "Gaskets, Packings, and Seals." Address Armstrong Cork Company, Gaskets and Packings Department, 1501 Arch St., Lancaster, Pa.

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- Tank strap cushions
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- · Felts for vibration-damping and
- Resilient floorings
- Carburetor floats and other fabricated natural or composition cork specialties

ARMSTRONG'S Gaskets, Packings, and Seals

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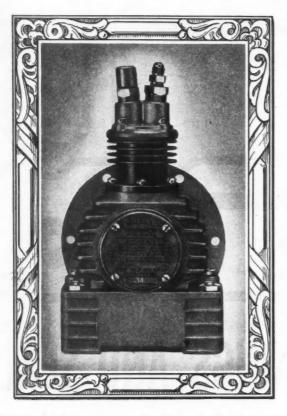
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PUT BUFLL AIR COMPRESSOR IN YOUR POST WAR PICTURE



Why not investigate the possibilities of the Buell Air Compressor for your Post War Production. The many ways in which it can serve your needs may surprise you. Thousands are in active service in Canadian fighter and bomber planes. Their precision workmanship, demanded in aviation products, assures long service without frequent parts replacement. Designed for compactness and light weight, they will fit into surprisingly close quarters. Put air to work! It is clean, powerful and reliable. Write us, advising all details as to volume and pressure, etc., and our engineers will gladly aid you in solving your problem. We specialize in small, high speed compressors of the highest quality.

BUELL MANUFACTURING CO.
Dept.AA 2975 COTTAGE GROVE AVE., CHICAGO, ILL

methyl cellulose, are of interest and show promise for aircraft applications because of the toughness, flexibility and elasticity of the film. They are soluble in carbon tetrachloride and the alcohola

3. The polyvinyl adhesives — the chloride, acetate and butyrate—possess excellent adhesive qualities, and are being used currently for special airframe applications. These adhesives are soluble in the ketones, chlorinated hydrocarbons, toluene and benezene. The types of these cements manufactured by duPont possess excellent characteristics,

4. The acrylic resin cements which are the polymers of acrylic acid derivatives, such as polymethyl and polyethyl acrylate, produce colorless films which dry by solvent evaporation and have good adhesion, elasticity, flexibility and chemical resistance. They are soluble in ethyl and butyl acetate. The monomer of methyl methacrylate or a 50:50 mixture of methylene dichloride and monomer are used as adhesives in the repair of the Plexiglas and Lucite transparent plastic parts which are specified generally for aircraft windows, turret domes, etc. The monomer and mixture require the addition of benzoyl peroxide as a catalyst. Hydroquinone is added to the monomer as a retarder for storage purposes, and benzoyl peroxide must be added to counteract this retardant when the monomer is used to permit polymerization to begin. The acrylic cements, as manufactured by Rohm & Haas and duPont, are very satisfactory.
5. The phenol formaldehyde thermo-

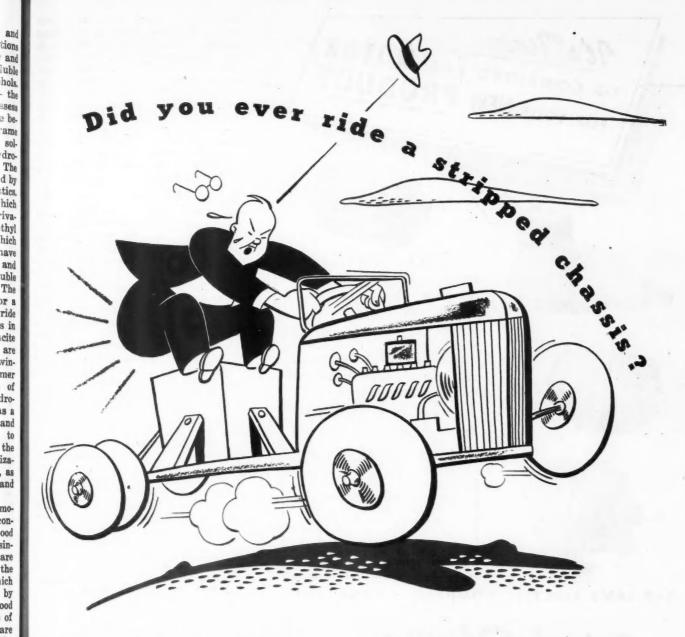
setting adhesives, used in aircraft construction for bonding wood or plywood parts, consist of either high resincontent alcohol solutions which are hardened by heat and pressure or the water soluble phenolic cements which are made suitable for cold bonding by the addition of a catalyst. Two good examples of the alcohol soluble type of phenol formaldehyde adhesives are Durez No. 12041 and Catabond No. 590. Various special modified phenolic adhesives have been introduced during recent years to be used as sealers, binders, insulants on electrical apparatus, etc.

6. The urea-formaldehydes are another type of thermosetting adhesives.

(Turn to page 102, please)







Unsprung weight has a heyday

With less weight above the springs to counteract the rebound of unsprung weight, you take an awful beating. And right there you have conclusive evidence that unsprung parts should also have the weight-reduction specialist's attention.

The use of aluminum alloys to accomplish such weight savings isn't a new idea. Aluminum wheels have run millions of miles in heavy-duty service. Trucks, experimentally equipped with aluminum rear axles weighing only 193 pounds compared to a previous 329 pounds, have run nearly a million miles. Brake assemblies, taking their cue from those installed on airplanes, show a 40 to 50% weight reduction through the use of aluminum.

Alcoa Aluminum Alloys will help you show better performance of the equipment you have rolling on the highways today.

ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Penna.

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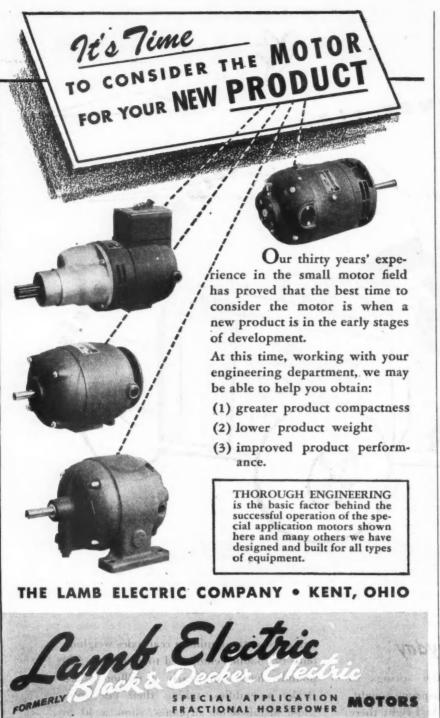
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They usually consist of a urea resin plus a hardener which is an organic material, such as melamine, to promote the rapid polymerization of the resin. The bond is commonly affected by heat and pressure, but satisfactory adhesion may be obtained by curing at room temperature (70 F) for a longer time, Modified urea formaldehydes are a compromise between the phenolic and unmodified urea characteristics. Plaskon, Cascamite ANS, Perkens D-111 and Uformite 500 are good examples of the urea adhesives.

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Special Adhesives

Excellent results in bonding rubber and synthetic rubbers to various materials have been obtained by the use of the Cycle-Weld procedure developed by the Chrysler Corp. This process gives very high bond strength, and it is particularly adaptable to aircraft construction within the limitations imposed by the curing heat required. The cements used in this process have been declared confidential by the U. S. Government, but the details of the procedure, in brief, are as follows:

The rubber to be bonded to any surface must first be cyclized by treatment with concentrated sulphuric acid for 5 to 10 minutes. The other material to which the rubber is to be bonded must be cleaned thoroughly, but in such a manner as not to have a deleterious effect on the surface. The rubber, after the acid treatment, should be thoroughly washed with water and dried. It is then flexed to produce a finely cracked surface. The cyclized rubber surface and the cleaned surface of the other material are then coated evenly with the Chrysler cement by brush or spray. A predrying period is required before the bond is affected. The cement coated surfaces may be air dried for four hours or air dried for 30 minutes then baked at 180 F. for 10 minutes. The assembly is then made and pressure (approximately 30 psi) is applied to insure intimate contact between the cement coated surfaces. The assembly is then cured by the suitable application of heat. The curing cycle is approximately 15 min. at 300 F. or a lower temperature 260 F. for one hour.

This process should not be used in-(Turn to page 104, please)



CORROSION RESISTANCE

...and its importance in aircraft metals

Corrosion is a complicated subject... but many forms of it yield to a simple solution.

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All of the INCO Nickel Alloys withstand the attack of all these potential corrosion producers:

Marine atmosphere • salt water • compressed oxygen • ethylene glycol (Prestone) • fire-fighting solutions • anhydrous ammonia and other refrigerants • alkalis and numerous acid conditions • tetraethyl lead and other high-octane gasolines and their combustion products.

In addition, the Inco Alloys...Inconel, Nickel, and the various forms of Monel ...have other properties essential to In addition, they have relatively high endurance limits under corrosive conditions. Their endurance is often better than that of steels which may have shown higher values when tested in non-corrosive surroundings.

Four Practical Examples

Typical of the important service of INCO Nickel Alloys in aircraft is the use of Monel in the Pitot-Static Tube, made by Pioneer Instrument Company.

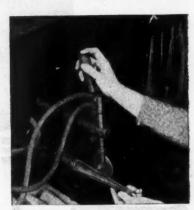
Since three vital flight instruments depend upon its accuracy, the Pitot-Static Tube must deliver true pressures from the air stream under all flying conditions.

In the words of the makers... "The problem of durability in a corrosive at-

mosphere dictated the selection of a special Monel sealed tube body. This . . . completely solves the problems of 'peeled plating' and . . . gives greater hardness and increased resistance to accidental shock or bending. The de-icing electrical heating element is... sealed in a Monel sheath . . . effectively preventing the corrosive effects from moisture seepage."

Another example is the use of Inconel exhaust manifolds on Pan-American Clippers. The manifolds withstand constant vibration and the continuous blast of corrosive high-octane exhaust gases at 1500° F.

Since Monel is practically immune to corrosion by high-octane aviation fuels, it is widely used throughout fuel lines for strainers, screens, valve parts,

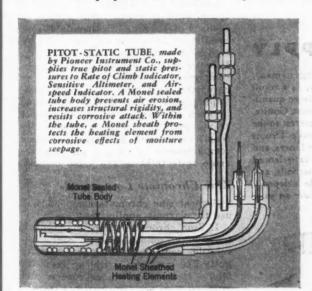


STRAINER FOR AVIATION FUEL NOZZLE is made of Monel wire cloth ... resists corrosion by high octane fuels and by atmosphere, Monel wire cloth is electrically welded . . . illustrating workable properties of Monel.

primer tubes, fuel selector valves and fuel pumps.

One such use is the Monel wire cloth strainer for aviation fuel nozzles, made by Michigan Wire Cloth Co., Detroit.

Another is the use of Monel in the Fuel Booster Pump, made by Thompson Products, Inc.,... the pump which confines within the tank the millions of bubbles that form in gasoline at high altitudes and would cause vapor lock and engine failure if allowed to pass into the fuel lines.



the continuous performance of important aircraft parts.

"Plus" Properties of Inco Nickel Alloys

All are strong and tough. Each possesses specialized properties...extra hardness, in "K" Monel; fast-machining, in "R" Monel; extra heat resistance, in Inconel; etc....which fits it for specialized jobs.

Corrosion tests conducted in marine atmospheres show uniformly high resistance by all 8 INCO Nickel Alloys. Some surface discoloration may occur ...but there is no loss in tensile strength.

FUEL-BOOSTER PUMP, made by Thompson Products, Inc., guards bigb-flying plames against bubbles in gas tank. Monel rotating cup seal and seal gasket retaining washer are, in words of Pioneer engineers," extremely important to life and proper functioning of pump." Monel bypass valve washer and valve guidecup are also used.



For further data about corrosion as it affects the choice of aircraft metals...and for other valuable information about the INCO Nickel Alloys (high and low temperature properties, heat transfer, mechanical properties, fabrication, etc.) write for the new booklet, "INCO Nickel Alloys for the Aircraft Industry." Address:

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL ST., NEW YORK 5, N.Y.



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discriminately in aircraft production. It should be used only when careful consideration has been given to the assembly involved. It is particularly adaptable to the bonding of flat sections, but curved assemblies will require special jigs for curing. Note: There are other Cycle-Weld cements used for bonding ferrous, and non-ferrous metals, wood, glass, plastics, etc., to themselves or other materials.

In bonding asbestos and treated felts to metal, where the assembly will be subjected to high temperatures (up to 350 F. approx.), the author has obtained satisfactory results by the use of Foster I.B.M. A-90 cement. The metal is first thoroughly cleaned and the cement is spread evenly over the surfaces to be bonded. The fibrous materials may require more than one coat of cement because of their The bond is affected when porosity. the solvent has partially evaporated, and the cemented assembly is subjected to a firm even pressure to insure the intimate contact of the faying surfaces. The assembly should be air cured at least 24 hours before use.

Sealants

In aircraft construction, a variety of sealants are used to insure watertightness, airtightness in compartments, and to prevent the leakage or seepage of gasoline or other fluids used in aircraft from tank sections. Watertightness is a prime requisite for the hulls of Naval seaplanes. This is accomplished by the insertion of zinc chromate compounds or zinc chromate impregnated fabric tape or equivalent between all faying surfaces or exterior seams and, as specified, between the seams of interior bulkheads. Certain compartments of Army aircraft are made watertight in the same manner.

Zinc Chromate Compounds

Several zinc chromate compounds in use for various applications are:

1. Zinc chromate compound, type I, is a high solids, 98 per cent non-volatile content, and high viscosity putty-like material with an asbestos filler. It is used to pack corners and to fill cavities and depressions throughout the airplane in areas which cannot

(Turn to page 106, please)



New Improved Pick-Up No. 3000B

High Sensitivity . Constant Polarity . Operates at High Temperatures

The new ELECTRO Pick-Up 3000B was designed for use in internal combustion engines as a means, in conjunction with Model 3500E Knock Intensity Meter, to provide instrumentation for C.F.R. engines and for the determination of octane rating of fuels. It also can be used with Diesel engines for measurement of knock intensity as a function of horse-

power output, and with any other mechanisms where it is necessary to determine presence and amount of detonation. For pressure measurements in engines, compressors and enclosures our combined 3200 Pressure Pick-Up and 3700 Pressure Interpolator are recommended.

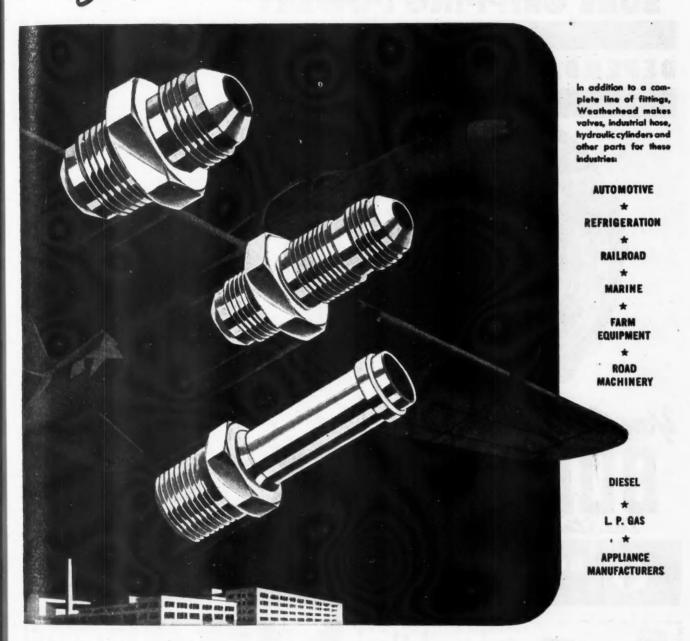
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CHICAGO, ILLINOIS

be drained effectively, and which, therefore, might constitute water traps. The entrappage and retention of water in one area will ultimately cause corrosion of the aluminum alloys which it contacts and this condition may result in an eventual structural failure. Pittsburgh Plate Glass Company's UL-10207 is an excellent example of this type of compound.

2. Zinc chromate compound, type II. is medium solids, 60 per cent nonvolatile content, and medium viscosity material with an asbestos filler which is used as a sealant between the faying surfaces of heavy gage (0.032 in. and up) aluminum alloys. Zinc chromate compound, type II-modified, is a medium viscosity material but is lower in solids than type II with 37 per cent non-volatile content. This latter compound is used between the faying surfaces of lighter gage aluminum alloys because the type II has a tendency to "cold-flow" under pressure which results sometimes in loose rivets. One pound of type II zinc chromate compound is mixed with one-half gallon of zinc chromate slushing compound to reduce it. Pittsburgh's UL-10208 and LF-18766 are excellent examples of type II and type II-modified zinc chromate compounds, respectively.

3. Zinc chromate compound, type III, is a high solids, 98 per cent non-volatile content, and high viscosity sealant with a mica filler. It is used for special sealing operations because it remains tacky for an indefinite period. It will not withstand as high a pressure as type I. Pittsburgh's UL-10209 compound is recommended for evalua-

tion.

4. Zinc chromate paste is a special compound with a non-volatile content of approximately 60 per cent. It has less filler added, and therefore, its viscosity is lower than that of type II—modified. It is used as a sealant between stiffeners, stringers, and other parts attached to the plane structure to prevent infiltration of condensed moisture between faying surfaces, and to provide additional corrosion protection between dissimilar metals. The paste is also used to coat the exterior surface of bearings or bushings which are

(Turn to page 108, please)









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5. Zinc chromate slushing compound is used mainly for coating the interior of aircraft metal fuel tanks to insure against leakage. The current demand for this material is diminishing. The coating applied is not affected by gasoline or oil and the non-drying film has excellent adherance to metal. The usual method of application is to coat the interior surfaces of integral tanks by brushing. The material may sprayed, but it has a tendency to clog the spray gun when the solvent is re-leased. In the case of non-integral tanks, a large quantity of the compound is placed in the tank, the tank is rotated in all directions, and then the excess material is drained off. Pittsburgh's RUL 10160 is of this type.

6. Zinc chromate impregnated fabric tape is used mainly for sealing seams in the hulls of Naval aircraft and the enclosures and pressurized cabin areas of Army airplanes. This material consists of a fabric tape pretreated with a zinc chromate compound to prevent the seepage of fluids through the joints by capillary attraction. After this, the tape is coated on both sides with zine chromate compound, type I, so that it is gasoline, oil and waterproof throughout. Zinc chromate tape is 0.018 in. thick approximately, as received, but is compressed to 0.011 in. thickness when riveted in a seam. The tape is designed to withstand, when assembled, internal fluid head pressures and the external pressures encountered under the impact of landing on water. It has fair adhesive qualities which permit it to be placed in position on metal prior to riveting. Pittsburgh's "Fabseal" is an excellent tape of this type. Note: Zinc chromate tape may be obtained in extruded form (Pittsburgh's "Chromseal") minus the fabric base. This type of tape offers certain production advantages in assembly, but it has a tendency to "cold flow" if the pressure applied is too great.

(Turn to page 110, please)





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All of the zinc chromate compounds are resistant to the more common fluids used in aircraft, such as, aromatic gasoline, oil, anti-icer, water, etc. However, they are soluble in ethyl and butyl acetate if thinning or removal is required. They may safely be used in contact with plain or anodized aluminum alloys or other metals and over zinc chromate primer. These compounds are generally used in aircraft construction because they form soluble chromate salts when in contact with moisture, and thus, act to inhibit and prevent corrosion.

Special Sealants

There are various special sealing compounds used in airframe construction for glazing, pressurized cabins, integral tanks and other miscellaneous items. These materials should be chosen carefully for the particular application involved, since they must possess specific characteristics and must not have a deleterious effect on the materials contacted. Various special sealants and their applications follow:

1. The choice of a glazing putty for use in sealing around the edges of Plexiglas or Lucite transparent methyl methacrylate plastics should be limited to those materials which have low shrinkage factors, have good adhesion and whose solvents will not have any adverse effects on the plastics con-The use of aromatic hydrotacted. carbons and some chlorinated solvents should be avoided in contact with methyl methacrylate plastics, particularly if they are stressed, since they will cause crazing of the plastic materials. In like manner, the solvents used in some glazing compounds may cause infiltration channels of laminated safety glass by attacking the polyvinyl interlayer. Minnesota Mining's EC-612 Thiokol glazing putty is considered a safe sealant. This material has a high non-volatile content and it should be kneaded before insertion in the chan-

2. The severe low temperature and low pressure conditions encountered in high altitude operations require that pressurized cabins and enclosures be maintained in some types of aircraft. (Turn to page 112, please)

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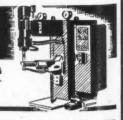
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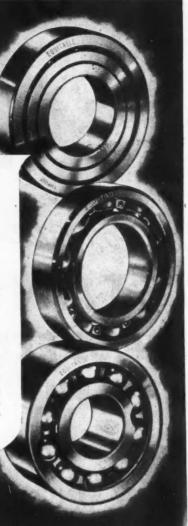
111



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application, standard or special.



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In these planes, all seams in the enclosed areas are sealed, and the heat and air pressure in the cabins are controlled constantly. Zinc chromate fab. ric tape is currently used as a sealant between the faying surfaces of the Minnesota Mining's seams. and EC-750A cabin sealer is used to fillet all seams on the interior. This latter material will provide an excellent seal and will insure against seepage of air and heat from the pressurized areas. Note: These are tests currently in progress which may indicate the use of zinc chromate tape unnecessary.

3. The ideal tanks for carrying fuel in aircraft are the Glenn L. Martin developed self-sealing tanks or Mareng bladder-like non-self sealing fuel cells, However, many aircraft because of the weight involved, fuel capacity or other considerations, have integral fuel tanks The problem of sealing incorporated. this type of tank is very serious and much thought has been given to it and much research work has been done in an effort to evolve a simplified standard sealing method. No easy method has been found to date. The author advocates the following method.

As tolerances permit, four ounces canton flannel, in accordance with Federal Specification CCC-D-451, type B, impregnated with phenolic varnish, in accordance with Navy Specification V-13, or zinc chromate impregnated fabric tape is inserted between the faying surfaces of seams. The impregnated canton flannel will compress to 0.025 in. approximately, and the zinc chromate tape to 0.011 in. aproximately. Both of these materials are resistant to aromatic gasoline. In assembly and prior to driving, Buna N synthetic rubber washers, 0.005 in. thick, are placed on the rivets. This material swells slightly, 5-10 per cent, when in contact with aromatic fuel and tends to affect a tight seal and to prevent seepage along rivet shanks.

The interior of the tank cavity is sprayed after assembly with two coats of Stoner-Mudge 1510A primer-sealer. This material is a Thiokol water dispersion with 10 per cent zinc chromate added. If necessary, Stoner-Mudge 1711 Thiokol sealer is used to fillet

(Turn to page 114, please)

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along all seam edges, stiffners, corner fittings, etc., on the tank interior to insure fuel tightness. It has excellent adhesion when applied over 1510A primer. The sealer may be obtained in three types depending on whether it is to be air, heat, or gas cured. Excellent results have been obtained by the use of these materials.

Sodium silicate (39-42.5 Be.) diluted in the ratio of one part to 4.5 parts of water plus a suitable wetting agent, is used for impregnating aluminum and magnesium alloy castings to prevent fluid seepage. The wetting agent is used to facilitate penetration of the solution into the pores of the castings. This method, however, is not intended for use in the repair of defective castings. The castings to be impregnated should first be thoroughly cleaned, then immersed in the sodium silicate solution which has been heated to 150-200 F. Pressures of 10 to 100 psi may be used, depending on the thickness of the walls of the castings, if capillary action is not sufficient to draw the impregnating materials into the pores. Other solutions, used for the same purpose but applied under different conditions, are: tung oil, styrene and phenolic varnish.

Floor Coating

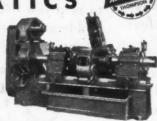
In the past, walkway and floor coverings for aircraft were cut to size from pyramidial rubber sheeting or equivalent and cemented into place. The rubber materials were wear and abrasion resistant, but it was very difficult to obtain a good rubber to metal bond; especially at the edges where there was a tendency to curl because of heavy traffic in certain areas.

The problem was solved finally by the development of a non-skid walkway coating which could be brushed or sprayed on floor panels or decks prior to or after assembly. This formulation was developed by the Glenn L. Martin Laboratories, and was based on Minnesota Mining's EC-498 Thiokol cement. Granulated cork, medium size particles, is added to the cement base in such a manner that the compound is cord loaded, and the particles remain in suppension during the storage period.

(Turn to page 116, please)

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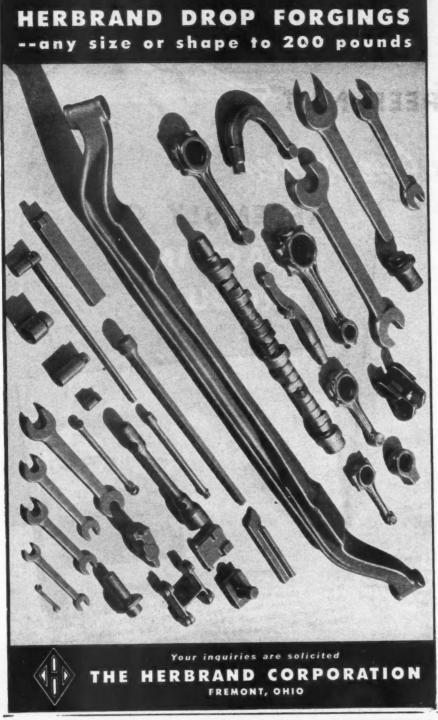
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The coating may be applied to bare aluminum or other metals and over zine chromate primer or other lacquer or enamel finishes. It possesses excellent adhesion, but it should be allowed to dry at least 24 hours before use. The coefficients of sliding friction are: dry—0.400, wet with water—0.395, wet with hydraulic oil—0.480. The material has excellent wear resistance. It has withstood 100,000 passages of people walking on it, equal to a five year period of approximately 50 passages per day, with no exposure of the cork or reduction of non-skid properties. It also has good weathering characteristics,

The weight of the coating is 0.105 lb per sq ft. The moisture absorption per sq ft under constant immersion for one week was very low and equaled 0.576 grams. The adhesion was not impaired by immersion and the coating swelled only slightly. This material is resistant to all fluids commonly used in aircraft, such as aromatic fuel, hydraulic and engine oil, anti-icer fluid, paint solvents, etc. It may be reduced with ethylene dichloride to compensate for solvent evaporation. Minnesota Mining's EC-744 is recommended for enclosed areas in aircraft because it does not have the characteristic Thiokol odor.

In conclusion, the author does not pretend to advise that the aforementioned adhesives and sealants are the only materials which may be used in aircraft construction. There are many other comparable products which will accomplish the same purposes satisfactorily. The products mentioned herein have been tested both by the Glenn L. Martin Laboratories and in service, and they are recommended solely for consideration on that basis.

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(Continued from page 32)

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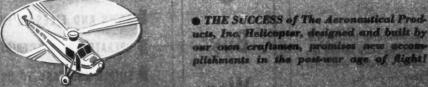


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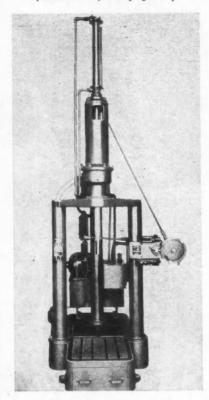
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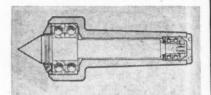
(Continued from page 58)



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